FURUNO

OPERATOR'S MANUAL

SATELLITE COMPASS

MODEL SC-120

FURUNO ELECTRIC CO., LTD.
NISHINOMIYA, JAPAN

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⚠ SAFETY INSTRUCTIONS

Safety Instructions for the Operator

⚠ WARNING

Do not open the equipment.

Only qualified personnel should work inside the equipment.

Do not disassemble or modify the equipment.

Fire, electrical shock or serious injury can result.

Immediately turn off the power at the switchboard if the equipment is emitting smoke or fire.

Continued use of the equipment can cause fire or electrical shock. Contact a FURUNO agent for service.

Do not place liquid-filled containers on the top of the processor unit.

Fire or electrical shock may result if the liquid enters the equipment.

⚠ CAUTION

No one navigation device should ever be solely replied upon for the navigation of a vessel.

Always confirm position against all available aids to navigation, for safety of vessel and crew.

Use the proper fuse.

Use of a wrong fuse can result in damage to the equipment.

Safety Instructions for the Installer

⚠ WARNING

Do not open the cover unless totally familiar with electrical circuits and service manual.

Improper handling can result in electrical shock.

Turn off the power at the switchboard before beginning the installation.

Fire or electrical shock can result if the power is left on.

Do not install the equipment where it may get wet from rain or water splash.

Water in the equipment can cause fire, electrical shock or damage to the equipment.

NOTICE

Observe the following compass safe distances to prevent interference to a magnetic compass:

	Standard Compass	Steering Compass
Display unit SC-602	0.5 m	0.3 m
Processor unit SC-1201/1201D	1.3 m	0.8 m
Antenna unit SC-1203F	0.3 m	0.3 m
DGPS beacon antenna GR-8	0.3 m	0.3 m

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FOREWORD

A Word to the Owner of the SC-120

FURUNO Electric Company thanks you for purchasing the FURUNO SC-120 Satellite Compass. We are confident you will discover why the FURUNO name has become synonymous with quality and reliability.

For over 50 years FURUNO Electric Company has enjoyed an enviable reputation for quality and reliability throughout the world. This dedication to excellence is furthered by our extensive global network of agents and dealers.

Your satellite compass is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless properly installed and maintained. Please carefully read and follow the operation and maintenance procedures set forth in this manual.

We would appreciate feedback from you, the end-user, about whether we are achieving our purposes.

Thank you for considering and purchasing FURUNO.

Features

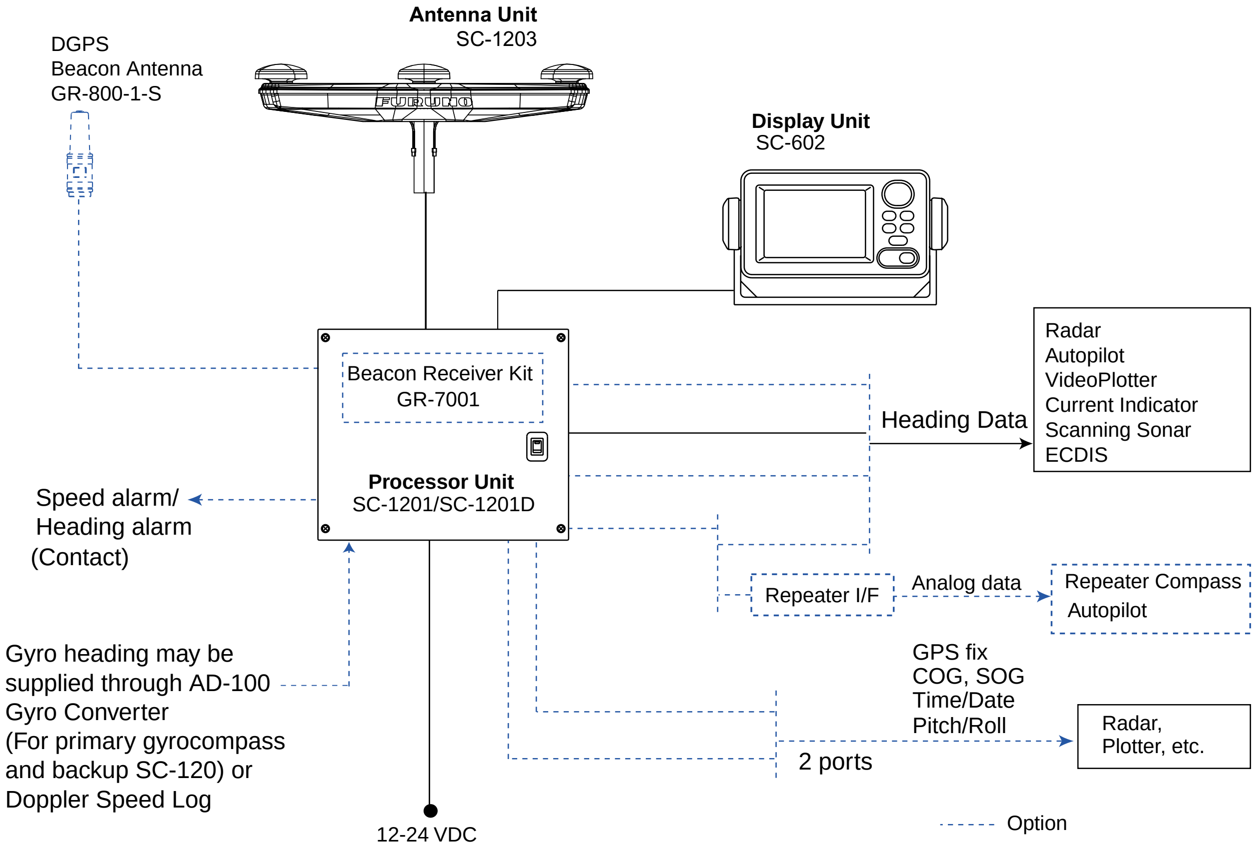
The SC-120 is a new satellite compass designed with FURUNO's advanced GPS kinematic technology. This compass finds a wide range of applications for any type of ships and mobile units at sea or on land.

The main features are

- Perfect for use as heading sensor for Radar/ARPA, AIS, ECDIS, scanning sonar, and video plotter
- There are no mechanical parts such as gimbals or rotating motor, thus the compass is free from routine maintenance
- The performance is not affected by geomagnetism thus it is suitable for use on any vessel
- No need for speed correction like a gyrocompass
- Short settling time - four minutes
- Provides all necessary functions as a GPS navigator.

SYSTEM CONFIGURATION

The SC-120 consists of three SC-series antennas, a display unit and a processor unit. The tri-antenna system helps reduce the influence of ship's motion (rolling).



System configuration

EQUIPMENT LIST

Standard supply

Name	Type	Code No.	Qty	Remarks
Antenna Unit	SC-1203F	—	1	
DGPS Antenna	GR-800-SC-1-S	—	1	No whip antenna For SC-1201-D
Display Unit	SC-602	—	1	
Processor Unit	SC-1201	—	1	
	SC-1201-D	—		With beacon receiver
Installation Materials	CP20-02210	000-041-743	1	Accessories for Antenna Unit CP20-02241
	CP20-02203	—	1	Accessories for Display Unit Tapping screw, 5X20, 4 pcs.
	CP20-02220	000-041-748	1	Accessories for Processor Unit MJ-A3SPF0013-035 MJ-A6SPF0007-100 MJ-A7SPF0006-100 CP20-02221
Accessories	FP14-02801	—	1	Cover
Spare Parts	SP20-00901	004-377-600	1	Accessories for Processor Unit

Optional equipment

Name	Type	Code No.	Qty	Remarks
Cable Assy.	MJ-A6SPF0003-050	000-117-603	1	For AD-10 output, connector at one end, 5 m
	MJ-A6SPF0007-100	000-125-237	1	For AD-10 output, connector at both ends, 10 m
	MJ-A6SPF0012-100	000-133-817	1	Cross for NMEA output, 10 m
	MJ-A7SPF0003-050	000-136-730-01	1	For beacon/log/alarm signal output, connector at one end, 5 m
Antenna Cable Set	CP20-01700	004-372-110	1	30 m 3 pcs, for SC-1203
	CP20-01710	004-372-120		50 m
DGPS Beacon Receiver Kit	GR-7001-K	000-041-738	1	
Flush Mount F	OP20-29	000-041-405	1	For display unit
Flush Mount S	OP20-17	000-040-720	1	For display unit
Extension Cable	OP08-15-30	004-396-440	1	For DGPS, 30 m
	OP08-15-60	004-396-450		For DGPS, 60 m
Antenna Cable Set	OP08-17	004-392-510	1	For DGPS antenna
Whip Antenna	FAW-1.2	000-130-046	1	1.2 m
Whip Antenna	04S4176	000-112-845	1	2.6 m
Flange	OP20-31	004-378-230	1	

SOFTWARE VERSION LIST

DISPLAY UNIT:	205-1312-009
PROCESSOR UNIT:	205-1311-016
GPS1:	205-1313-004
GPS2:	205-1313-004
GPS3:	205-1313-004
DGPS:	085-0182-002

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SPECIFICATIONS OF SATELLITE COMPASS
SC-120

1 GENERAL

1.1	Receiver Type	12 discrete channels GPS
1.2	RX Frequency	1575.42 MHz (L1)
1.3	Class of Service	Standard Positioning service (SPS) using the C/A code on the L1 frequency
1.4	Processing	All-in-view, 8-state Kalman filter
1.5	Position Accuracy	10 m (GPS), or 5 m (DGPS), 95% of the time
1.6	Heading Accuracy	±0.6° (95% static accuracy)
1.7	Follow-up	25°/s rate-of-turn
1.8	Settling Time	4 minutes

2 DISPLAY

2.1	Display Type	4.5 inch monochrome LCD, 120 x 64 dots
2.2	Effective Area	95 mm (W) x 60 mm (H)
2.3	Contrast	64 steps
2.4	Display Mode	Heading, Nav data, Steering, Compass rose, Rate of turn and Speed modes

3 INTERFACE

3.1	Heading Output	3 ports: AD-10 or IEC 61162-1 Ed.2 1 port: NMEA 0183 (Ver1.5/2.0) IEC 61162 Sentences: HDT, HDM, VTG, ZDA, GGA, ROT
3.2	COG, SOG, L/L Output	1 port: IEC 61162-1 Ed.2 1 port: RS-232C level IEC 61162 Sentences: VTG, GGA, ZDA, GLL, ROT, PFEC, Gpatt (FURUNO P-sentences) ATT (Proprietary): incl. pitch, roll and yaw data $PFEC,GPatt,xxx.x,+xx.x,+xx.x<CR><LF> (Ver. 1.5) $PFEC,GPatt,xxx.x,+xx.x,+xx.x*hh<CR><LF> (Ver. 2.0)
3.3	Log Output	1 port: 200/400 pulse/nm (closure signal)
3.4	Alarm Output	1 port: Alarm signal (closure signal)
3.5	Heading Input	1 port: Backup Heading (AD-10/IEC 61162 format) from external heading device Sentences: HDT, HDG, HDM (VBW, VHW, VLW for tide direction and speed)
3.6	Beacon Data Input	1 port: RTCM SC-104 format for RS-232C

Sentences: MSK, GGA

5 POWER SUPPLY

12-24 VDC: 1.1-0.5 A

6 ENVIRONMENTAL CONDITION AND EMC

6.1	Ambient Temperature	
	Display/Processor Unit	-15°C to +55°C, Designed for protected area
	Antenna Unit	-25°C to +70°C, Designed for exposed area
6.2	Damp heat	93%±3% at 40°C
6.3	Waterproofing	
	Antenna Unit	IPX6
	Display Unit	IPX5
	Processor Unit	IPX0
6.4	Vibration	IEC 60945
6.5	EMC	IEC 60945

7 COATING COLOR

7.1	Display/Processor Unit	Panel: N3.0 Newtone No.5 (dark gray)
		Cover: 2.5GY5/1.5 (light gray)
7.2	Antenna Unit	N9.5 (white)

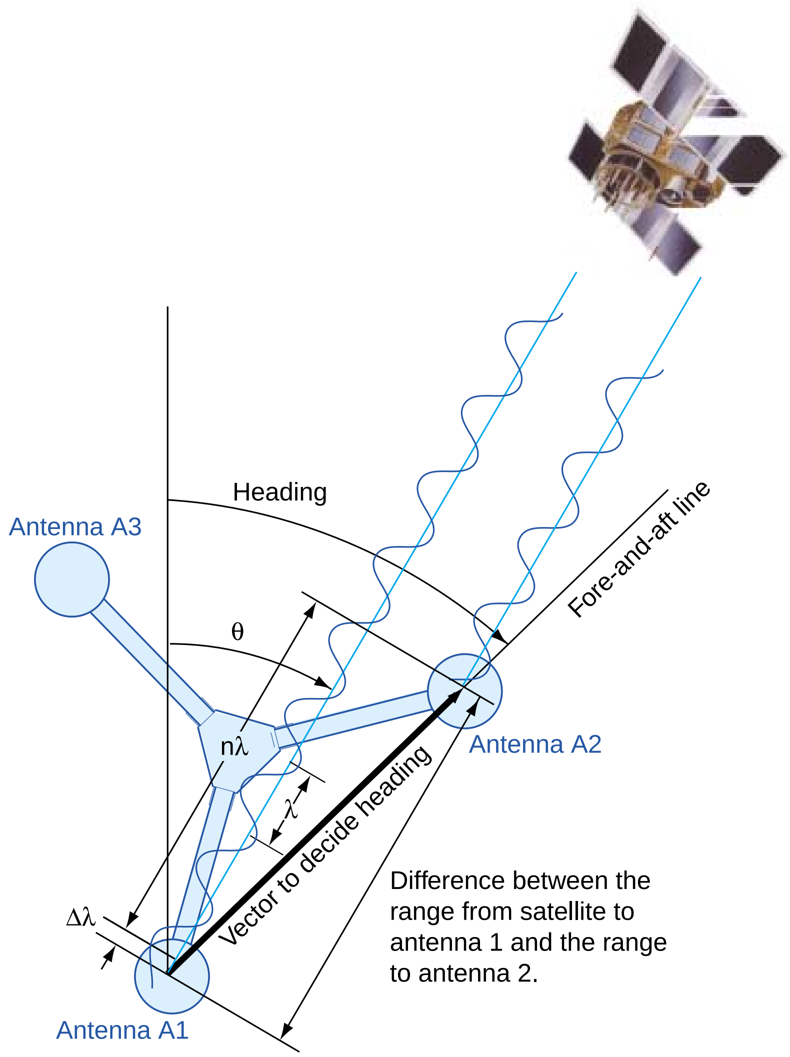
8 STANDARDS APPLICABLE

IMO MSC.116(73)	THD standards
ISO 22090-3	Under development
IMO A. 694(17)	General requirements
IEC 60945 version 4	General requirements (EMC tested to 2 GHz)
IMO A.819 (19)	Performance standard for shipborne GPS
IEC 61108-1	Performance standard for shipborne GPS
ITU-R M.1371 for AIS	Rate of turn

1 PRINCIPLE OF OPERATION

Own ship's heading can be determined by decoding the data in the carrier frequency in addition to ordinary GPS parameters. In principle, a pair of two antennas A1(ref) and A2(fore), each connected with an associated GPS engine and processor, are installed along the ship's fore-and-aft line. GPS systems at A1 and A2 calculate the range and azimuth to the satellite. Difference in range between A1 and A2 is $\Delta\lambda + n\lambda$ where λ is 19 cm. “n” is automatically found during the initialization stage by receiving three satellites. A fraction of a carrier wavelength, $\Delta\lambda$, is processed by FURUNO’s advanced kinematic technology in geographical survey, thus determining a vector (range and orientation) A1 to A2.

In reality, a third antenna is used to reduce the influence of pitch, roll and yaw, and five satellites are processed to obtain 3D data. If the GPS signal is blocked by a tall building or the vessel is under a bridge, the 3-axis solid-state angular rate gyros in the processor unit take place of the satellite compass, maintaining the current heading continuously.



Principle of satellite compass operation

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2 INSTALLATION

2.1 Mounting Considerations

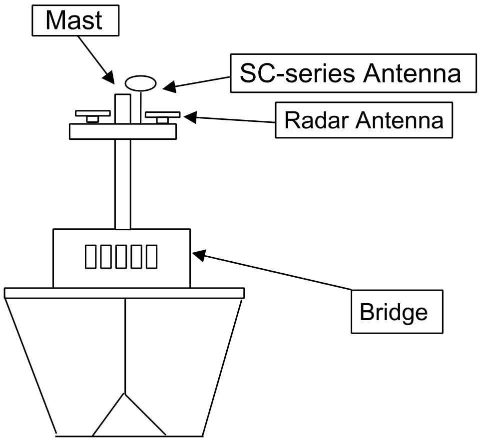
2.1.1 SC-series antenna unit

General

- Keep the length of antenna cable in mind when selecting a mounting location. The cable comes in lengths of 15 meters (standard supply), or 30 m or 50 m (optional lengths).
- Select a location where vibration and shock are minimal.

Installing the antenna above superstructures

The antenna must be mounted above all other structures on the vessel to obtain an unobstructed view of the satellites regardless of vessel heading. Failure to do so will cause shadows and multipath reflection problems.



Example of proper installation

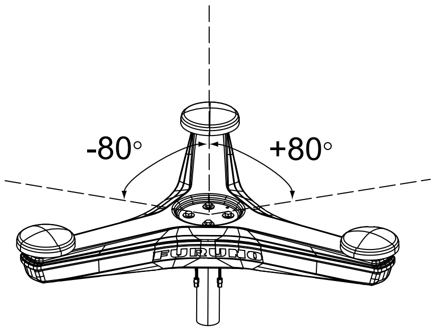
Installing the antenna below superstructures

If it is not possible to mount the antenna above all superstructures on the vessel, as shown in the illustration above, shading and multipath problems may occur on at least one heading, and possibly more. To possibly avoid those problems, observe the guidelines in this section.

> **NOTICE**
>
> **If the antenna is installed below any superstructure, the installation must be done over a two-day period, following the procedure in the service manual.**
>
> At least 12 hours are required to capture tracking data to measure multipath indexes and locate areas of shading.

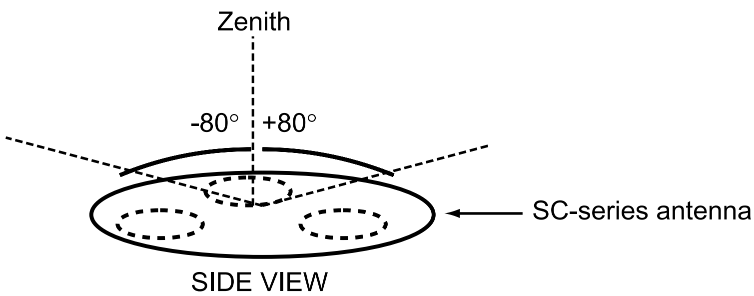
- The **horizontal separation** between the antenna and masts must be as follows:

Mast diameter	Separation distance (minimum)
10 cm	1.5 m
30 cm	3 m



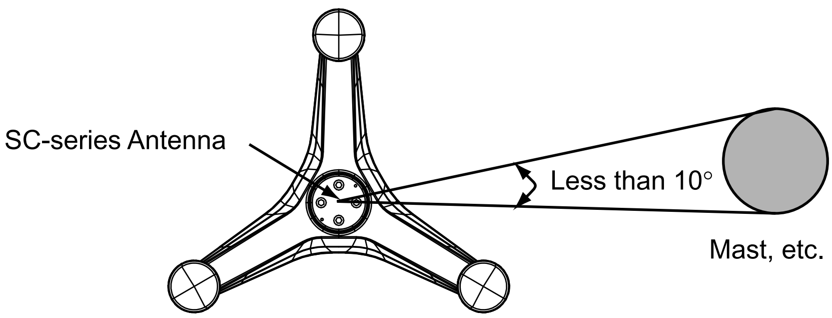
Separation degrees

- Keep the length of antenna cable in mind when selecting a mounting location. The cable comes in lengths of 15 meters (standard supply), or 30 m or 50 m (optional lengths).
- The field of view above the antenna should be as shown below, ±80° against zenith. To avoid reflections from masts and the like, locate the antenna well away from the shadows of the radar mast, etc.

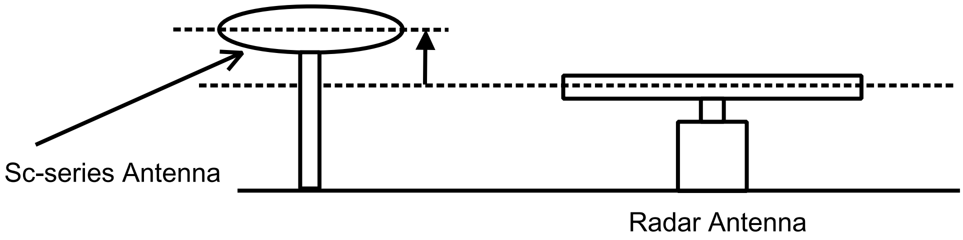


Antenna and field of view

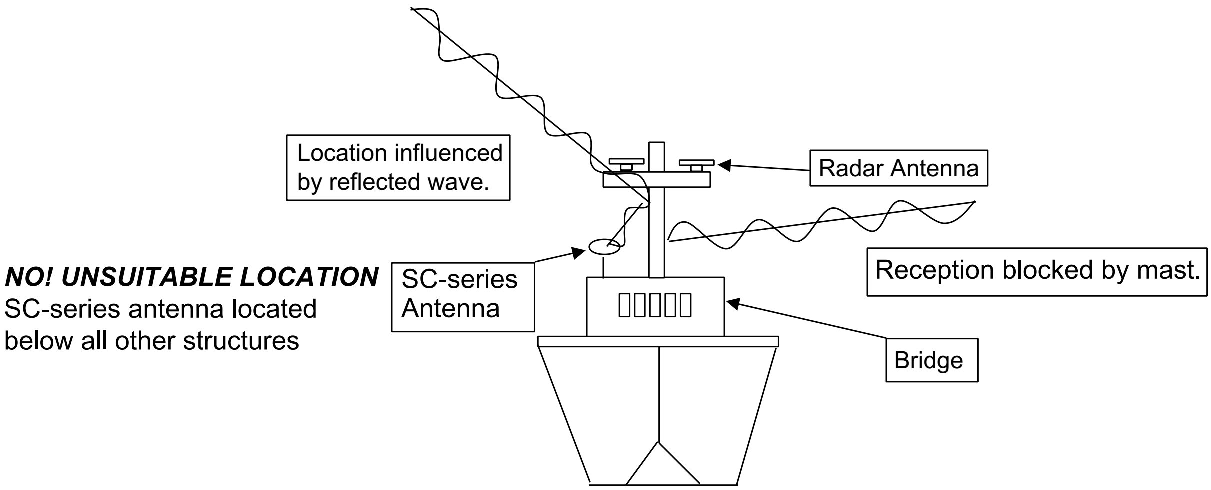
- Referring to the figure below, locate the antenna away from objects which might block reception, such as a mast.



- Locate the antenna above the radar antenna, out of the radar beam.



Example of improper installation



Example of improper installation

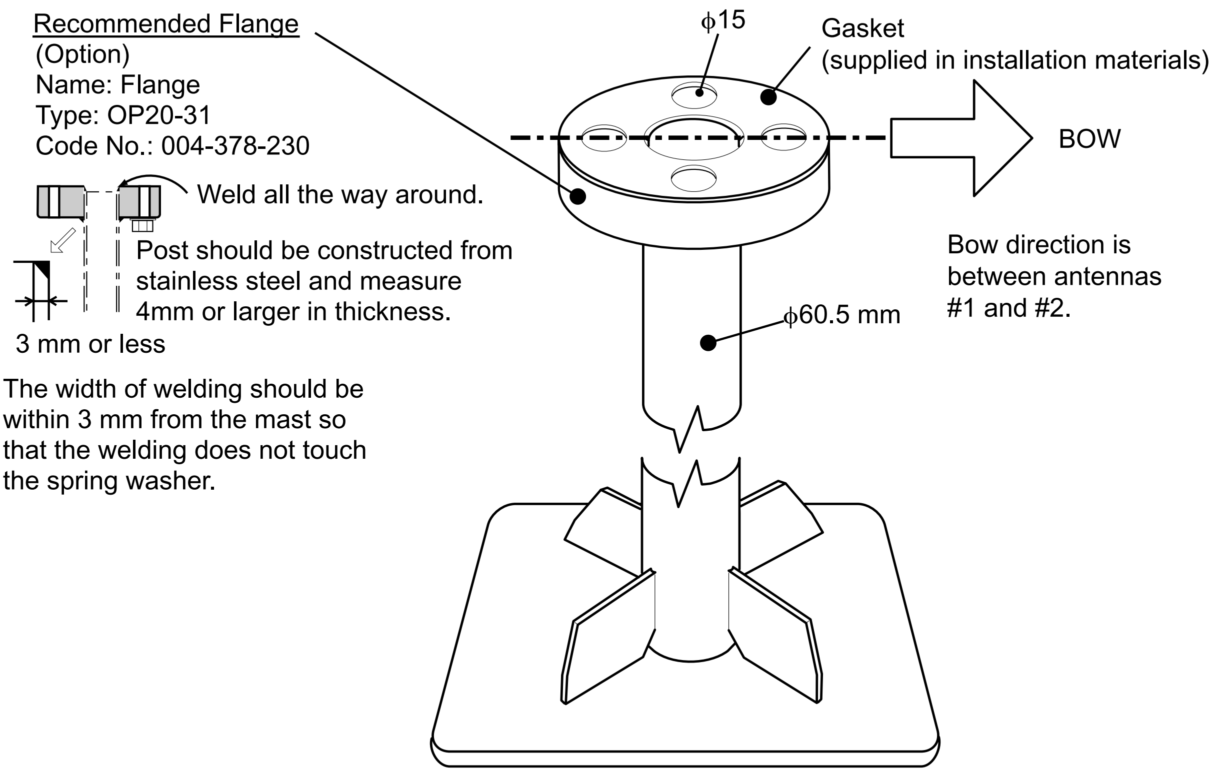
2.1.2 Display unit, processor unit

- Choose a location where vibration and shock are minimal.
- Install the units well away from locations subject to rain and water splash.
- Locate the units well away from air conditioner vents.
- Keep the units out of direct sunlight because of heat that can build up inside their cabinets.
- Choose a well-ventilated location.
- For the display unit, choose a location where it can be easily operated.
- Leave sufficient space around the units to permit access for maintenance. See the outline drawing for recommended maintenance space.

2.2 Installing the Antenna Units

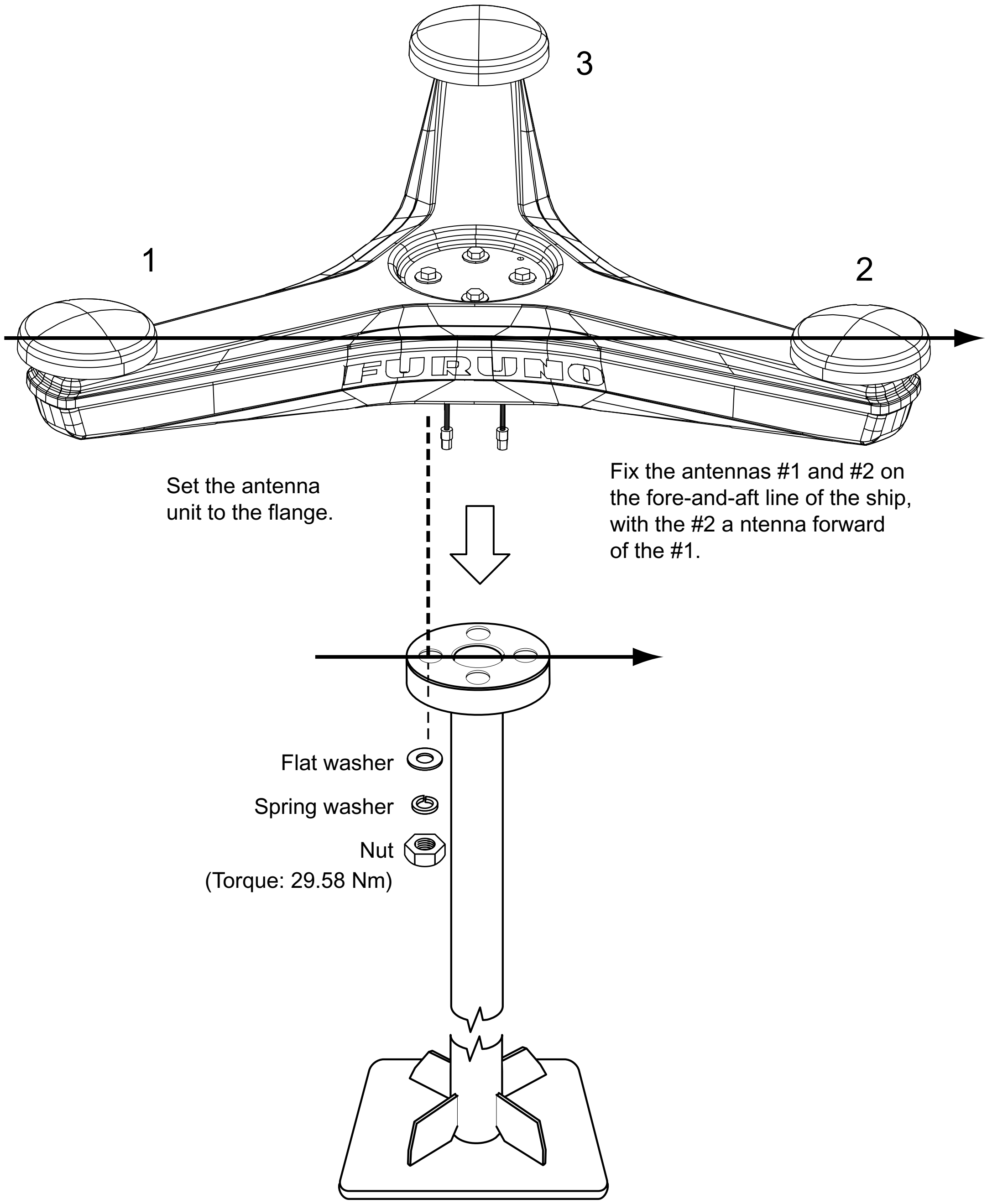
2.2.1 SC-series antenna unit

1. Prepare an installation post for the antenna in accordance with the illustration shown below.



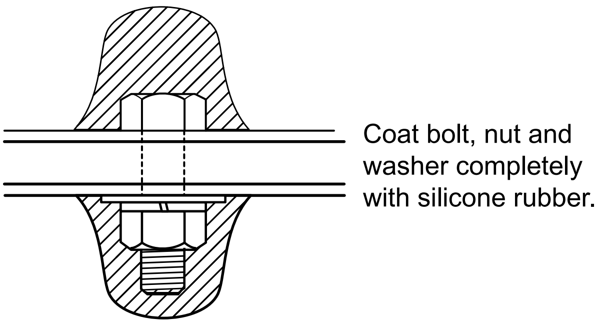
Installation post

2. Fix the antenna unit to the post as shown below.



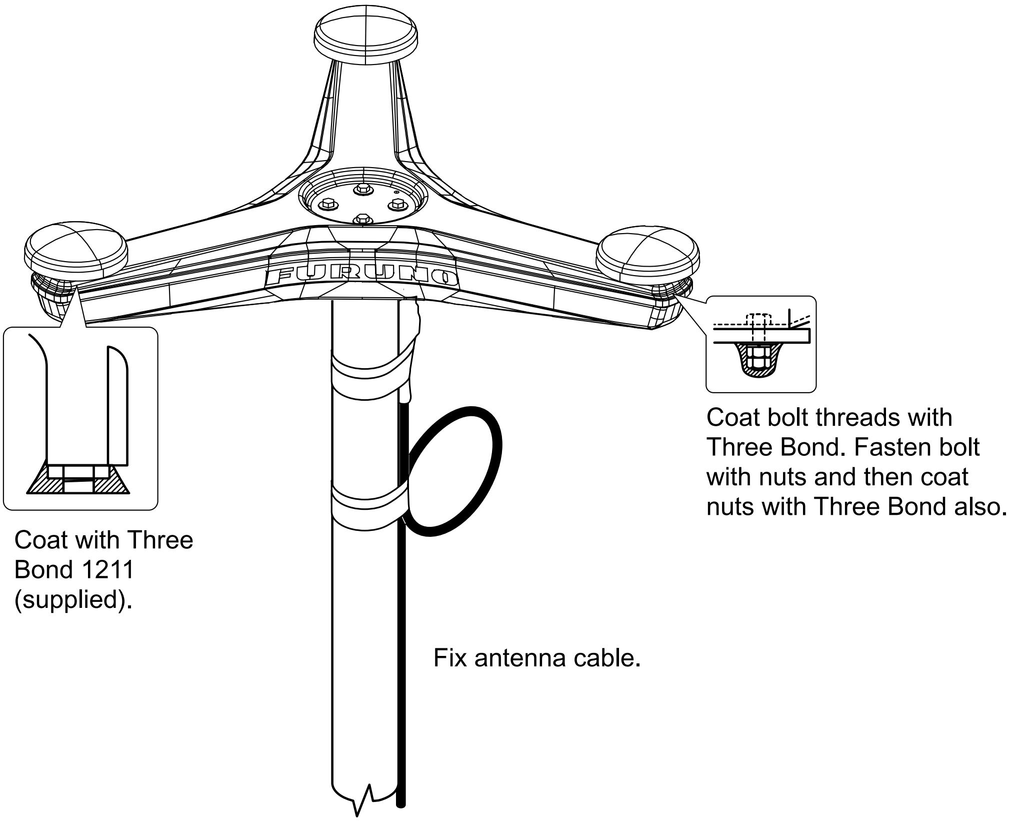
Fastening antenna unit to a post

3. Coat each nut, bolt and washer with silicone rubber for waterproofing.

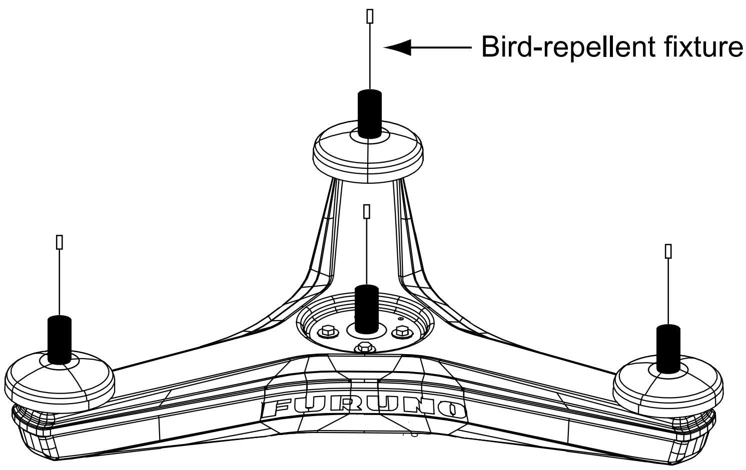


Coating bolt, nut and washer with silicone rubber

4. As shown below, make a loop in the antenna cable and fasten the antenna cable to the antenna post with two cable ties.



5. Coat bolt threads with Three Bond 1211. Fasten bolts with nuts. Coat nuts at the bottom of each antenna element with Three Bond 1211.
6. Paint post and support plate with anti-corrosive paint.
7. Attach “bird-repellent fixtures” (supplied) to each antenna element and center cover as shown right.



Antenna element

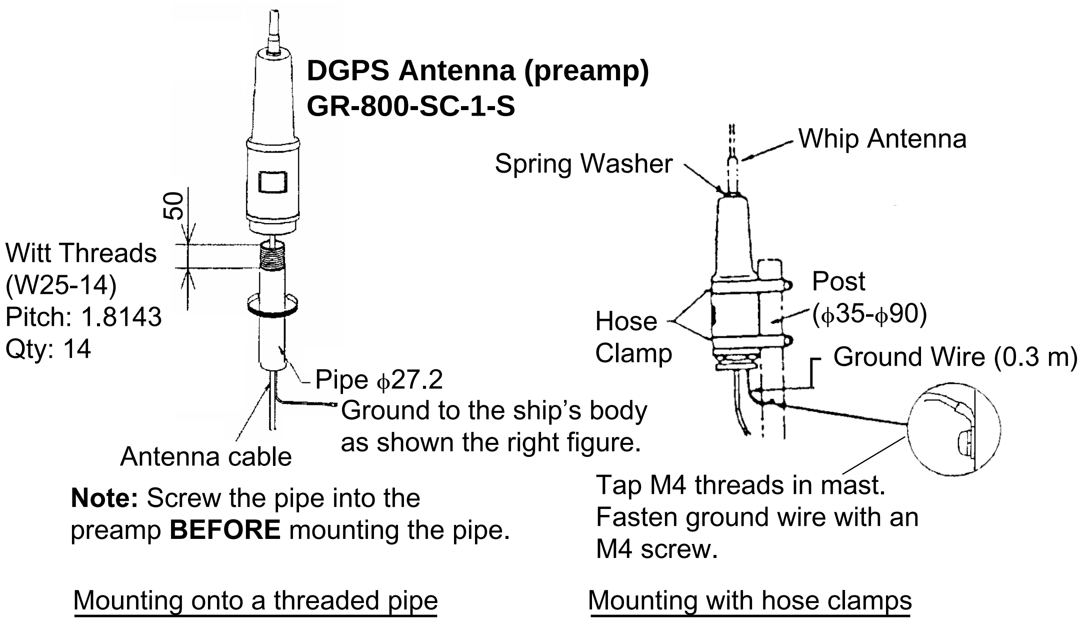
2.2.2 DGPS antenna unit

Choose a mounting location for the DGPS antenna considering the points mentioned below. DPGS is not necessary for heading determination, however it can improve the accuracy of GPS position fixing

- Separate the DGPS antenna at least three meters from a radio antenna.
- Do not install the DGPS antenna within the radar beam.

1. Mount the DGPS antenna by one of the methods below.
   - Screw it into a one-inch threaded pipe.
   - Fasten it to a steel post (ϕ35-ϕ90) with stainless steel hose clamps (local supply).

⚠ CAUTION
Ground the antenna to prevent receiving problems.

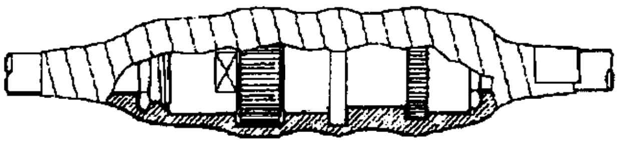


Mounting the DGPS antenna

2. Set the spring washer to the whip antenna (local supply) and screw the whip antenna into the antenna housing. Coat the washer with silicone sealant to prevent loosening.
3. Drill a tapping hole in the post for an M4 screw and fasten the ground wire there.

4. The DGPS antenna is supplied with a 15 m cable. If extension is necessary use the extension cable (option). Cover the extension connectors with vulcanizing tape and vinyl tape, for waterproofing. Tie tape ends with a cable tie.
   Extension Cable: Type: OP08-15-30, Code No.: 004-396-440 (30 m)
   Type: OP08-15-60, Code No.: 004-396-450 (60 m)

Name	Type	Code No.	Qty	Remarks
Connector	TNC-SA-JJ	000-139-113	1	
Cable	TNC-PS-3D L30M	000-139-078	1	30 m, connector at both ends
	TNC-PS-3D L60M	000-139-080		60 m, connector at both ends

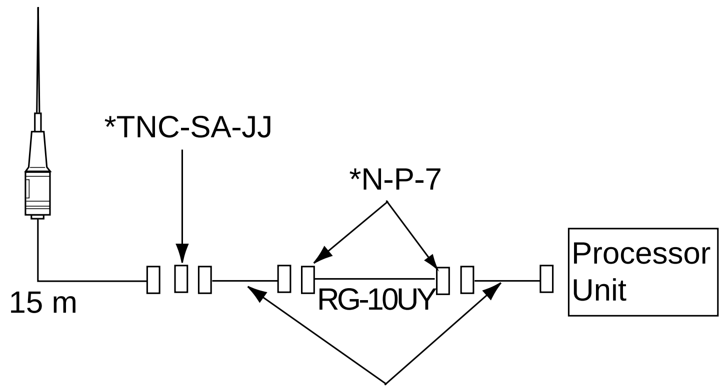


Waterproofing the extension connector

For coaxial cable RG-10UY (local supply, max. length 60 m), use the optional antenna cable set.

Antenna cable set Type: OP08-17, Code No.: 004-392-510

Name	Type	Code No.	Qty	Remarks
Converter Cable Assy.	NJ-TP-3DXV-1	000-123-809	2	
Connector	TNC-SA-JJ	000-139-113	1	
Connector	N-P-7	000-501-514	2	



* Converter cable assy. (supplied with antenna cable set)

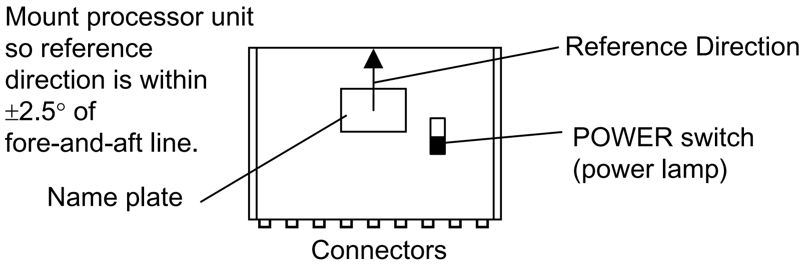
Cable connection when using cable RG-10UY

2.3 Installing the Processor Unit

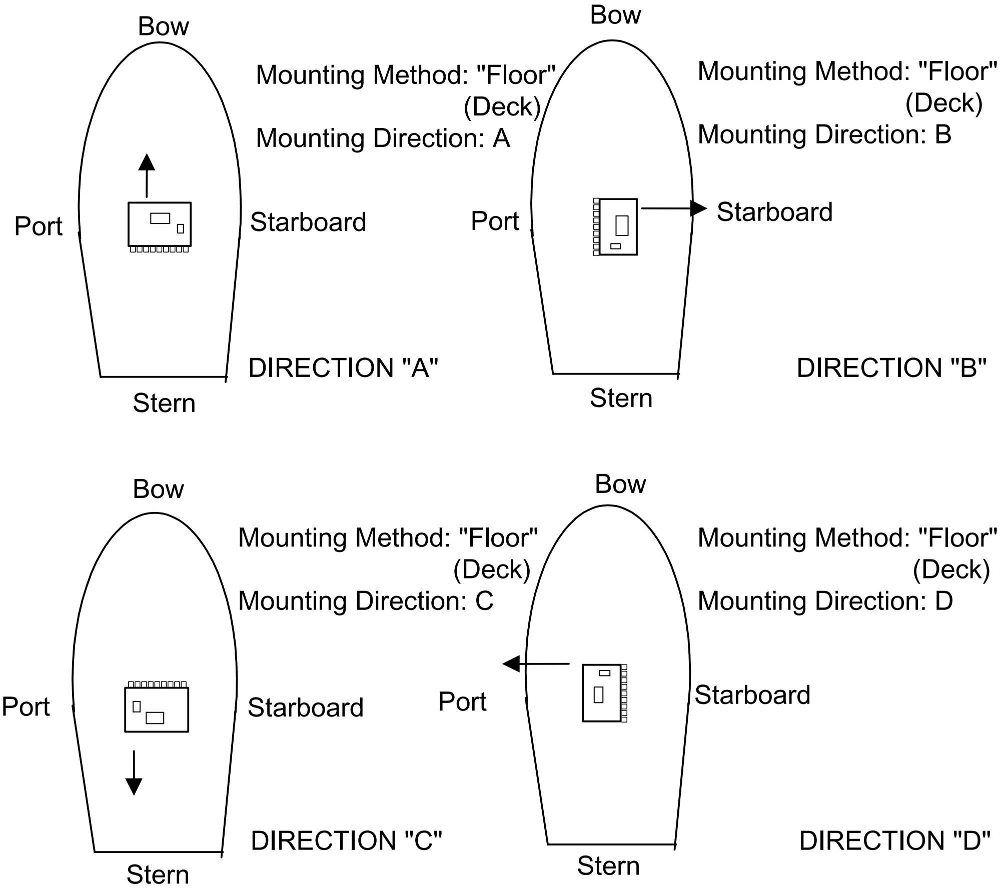
The processor unit should be mounted aligned with the ship's fore-and-aft line. It can be mounted on the deck, bulkhead, or on the underside of a desk. Choose a mounting location which allows you to easily view the power lamp on the top of the unit and which is within ±2.5° of the ship's fore-and-aft line.

2.3.1 Deck mount

1. The processor unit is factory adjusted for deck mounting. Fasten the processor unit to the mounting location with tapping screws (5 x 20, 4 pcs.). The unit can be oriented in one of the directions shown in the figure below. After the unit is installed you will specify the mounting method from the menu.



Processor Unit, top view



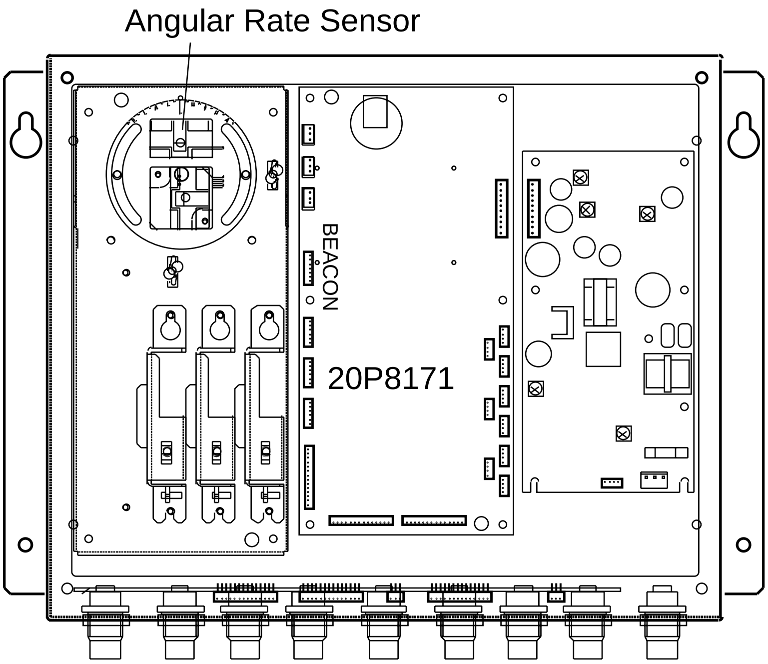
Processor unit orientation, deck mounting

2. Fasten the ground wire between the ground terminal on the processor unit and the ship's superstructure.

2.3.2 Bulkhead mount

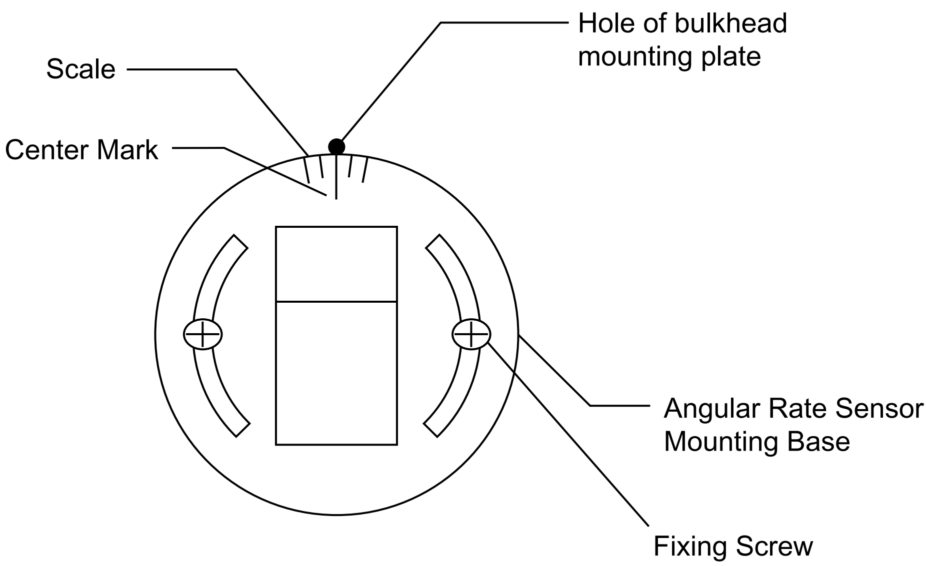
For mounting on a bulkhead, use the bulkhead mounting plate supplied with the installation materials.

1. Unfasten four screws from the top cover to open the front panel.
2. Unfasten two screws to dismount the angular rate sensor.



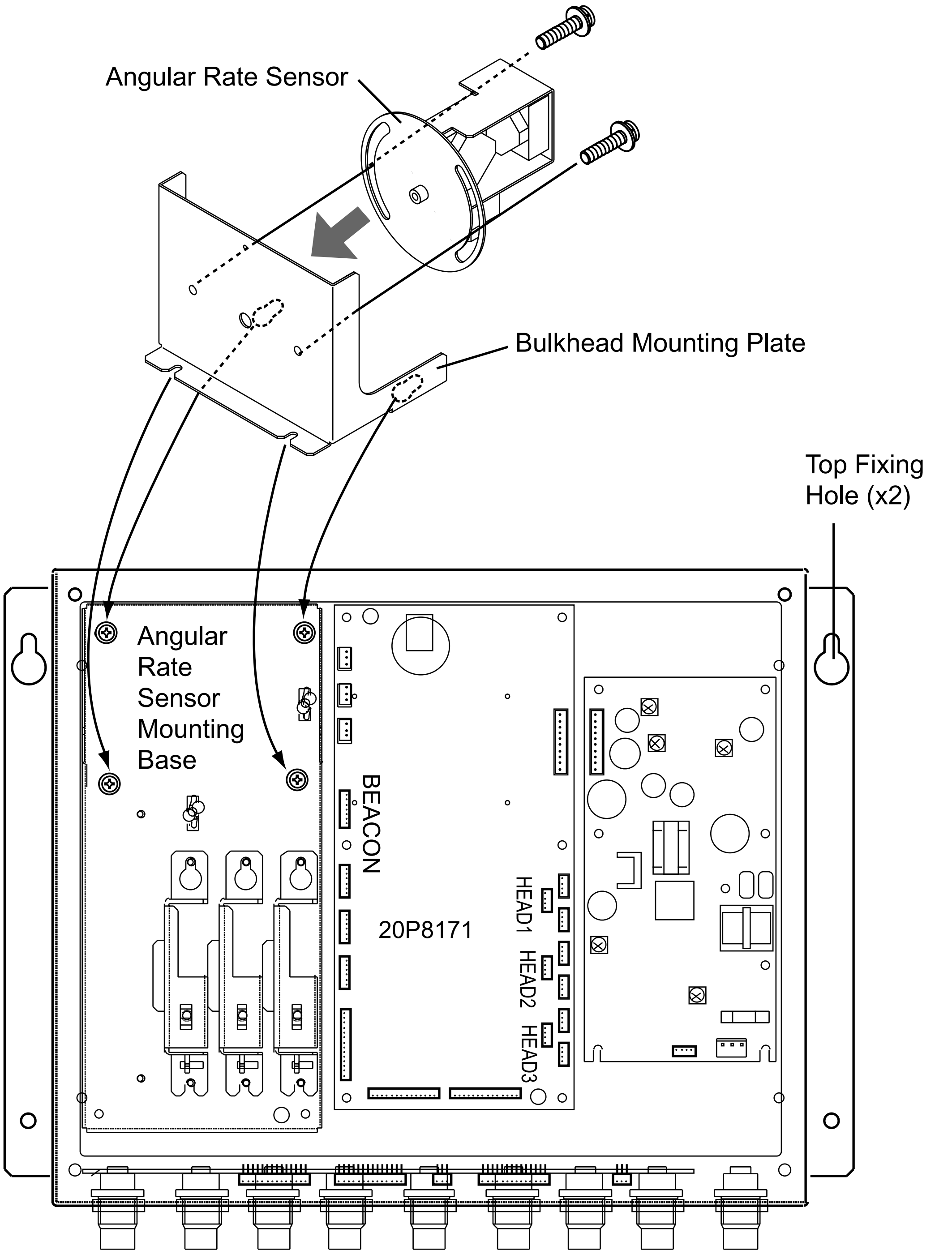
Processor unit, top view

3. Fasten the bulkhead mounting plate to the angular rate sensor. Align the center graduation on the angular rate sensor with the hole of the bulkhead mounting plate and tighten fixing screws.



Angular rate sensor, top view

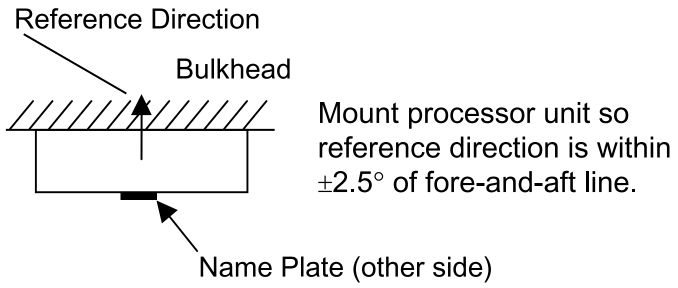
4. Loosen four screws on the angular rate sensor mounting base, and then fasten the bulkhead mounting plate to the angular rate sensor mounting base.

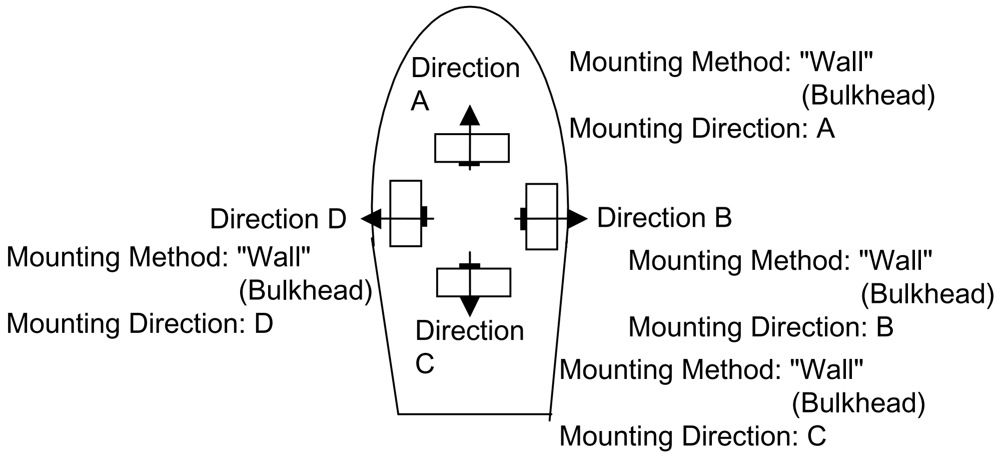


Processor unit, top view

5. Close the top cover of the processor unit.
6. Partially screw in two tapping screws for the top fixing holes of the processor unit in the mounting location. Hang the processor unit on the tapping screws, using the top fixing holes. Screw in two tapping screws for the bottom fixing holes, and then tighten the top fixing holes.

The unit can be oriented as shown in the figure below. After the unit is installed you will specify the mounting method from the menu.



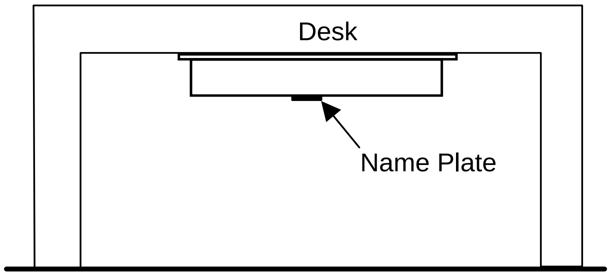


Processor unit orientation, bulkhead mounting

7. Fasten the ground wire between the ground terminal on the processor unit and the ship's superstructure.

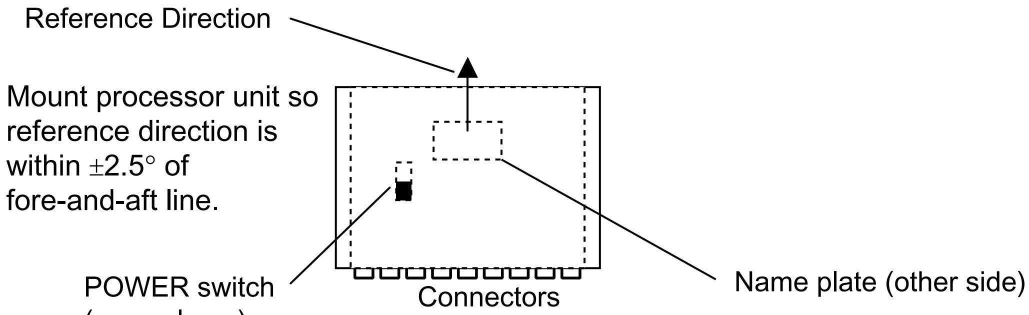
2.3.3 Installation on the underside of a desk

The processor unit may be mounted on the underside of a desk as shown in the figure below. **Do not install it on the overhead.**

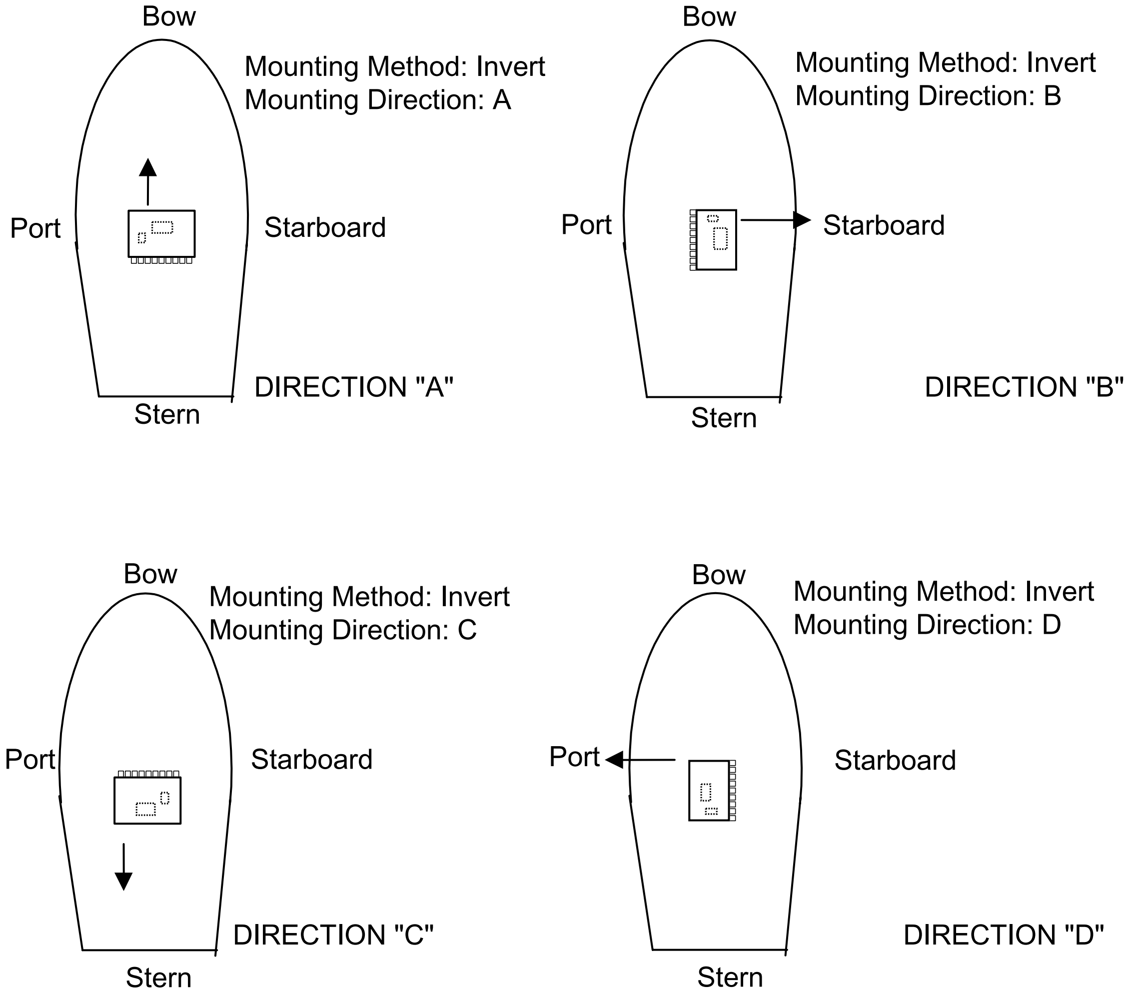


Installation of processor unit on the underside of a desk

The reference direction is as shown below. The mounting method is the same as that for mounting on the deck.



Processor Unit, rear view

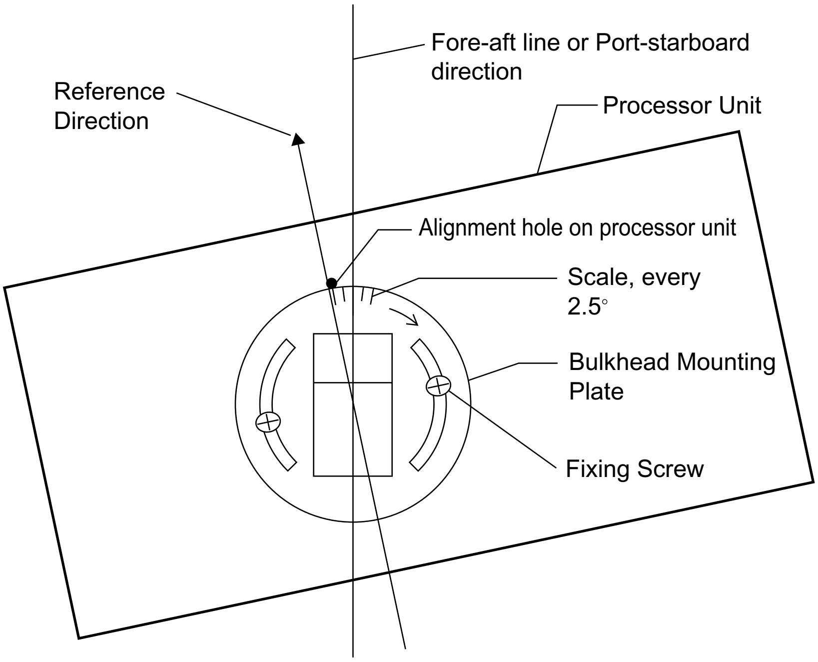


Processor unit orientation, installation on the underside of a desk

Mount the processor unit on a level surface with its name plate facing the bow, stern, port or starboard.

2.3.4 Adjusting for orientation error

It may be impossible to perfectly align the processor unit on the fore-and-aft or port-and-starboard line. Open the top cover, loosen the two fixing screws on the angular rate sensor and turn. For example, if the orientation error is 2.5° to port, rotate the sensor 2.5° starboard. The range of adjustment is -45° to +45°. Close the top cover after completing the adjustment.

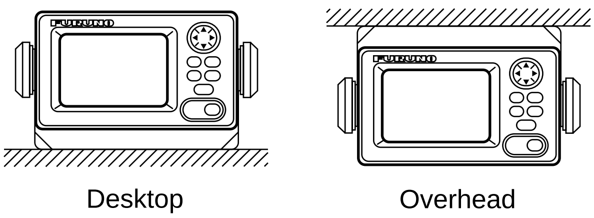


Angular rate sensor, top view

2.4 Installing the Display Unit

2.4.1 Desktop, overhead mounting

1. Fasten the hanger to the mounting location with four tapping screws (supplied). See the outline drawing for mounting dimensions.
2. Screw the knobs into the display unit.
3. Set display unit to the hanger and tighten the knobs.
4. Run the ground wire between the ground terminal on the display unit and the ship's superstructure.



Display unit mounting methods

2.4.2 Flush mounting

Two types of flush mounts are available. See the outline drawing at the back of the manual for details.

Flush mount "F"

Flush mount "F" kit Type: OP20-29, Code No: 000-041-405)

Name	Type	Code No.	Qty
Cosmetic Panel	20-016-1051	100-251-370	1
Tapping Screw	5X20	000-802-840	4
Hex Bolt	M6X12	000-862-127	2
Spring Washer	M6	000-864-260	2

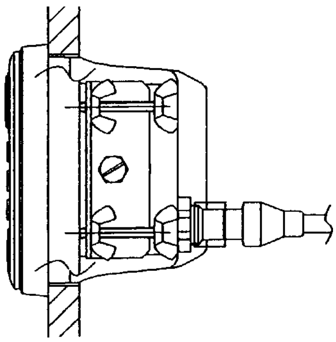
1. Make a cutout in mounting location. The dimensions are 183(W) x 92(H) mm.
2. Fasten the cosmetic panel to the display unit with hex bolts and flat washers.
3. Fasten the display unit to the mounting location with tapping screws.

Flush mount "S"

Flush mount "S" kit Type: OP20-17, Code No.: 000-040-720)

Name	Type	Code No.	Qty
Flush Mount Fixture	20-007-2401	100-183-190	2
Wing Bolt	M4X30	000-804-799	4
Wing Nut	M4	000-863-306	4
Hex Bolt	M6X12	000-862-127	2
Spring Washer	M6	000-864-260	2

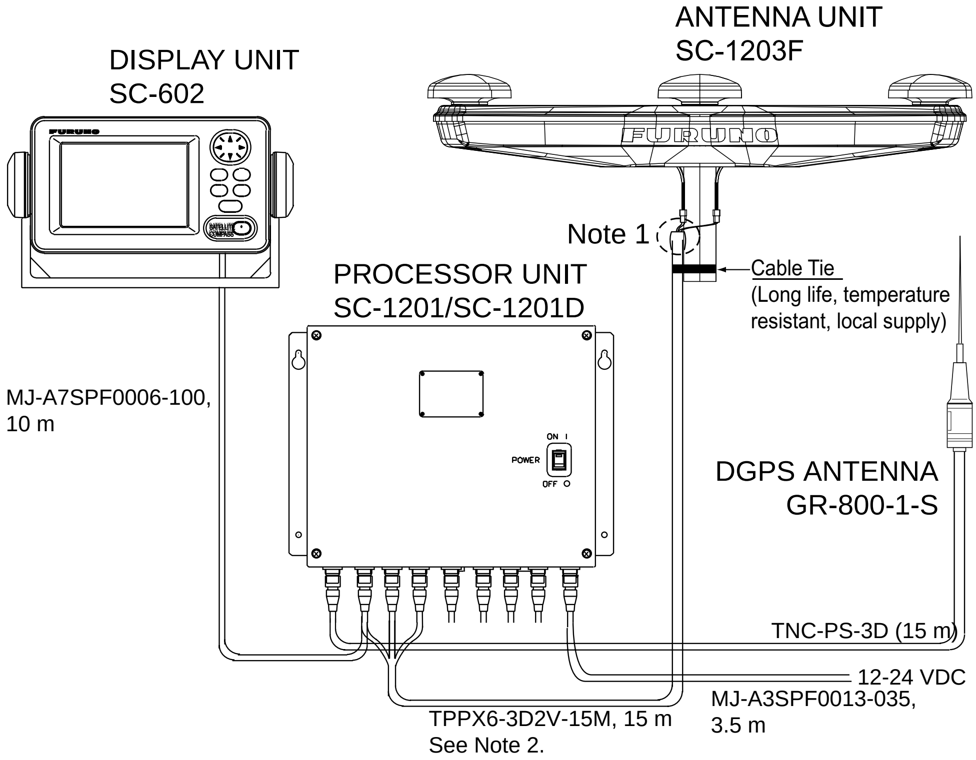
1. Make a cutout in the mounting location. The dimensions are 167(W) x 92(H) mm.
2. Place the display unit in the cutout.
3. Fix the display unit to the two flush mount fixtures with hex bolts and spring washers.
4. Screw the wing nut on the wing bolt.
5. Fix the display unit with the wing bolt and then tighten the wing nut.



Flush mount "S"

2.5 Wiring

This section covers general wiring. For further details see the interconnection diagram at the back of this manual.

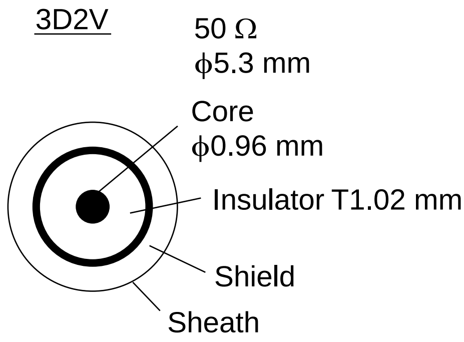


General wiring diagram

- The length of the cable between the display unit and processor unit is 10 m. Connect it to the DISPLAY port on the processor unit.
- The antenna cable is 15 meters (standard) long. Connect the three coaxial cables to the processor unit according to cable color as below. Incorrect connection will result in wrong heading.

Antenna	TPPX6-3D2V-15M	Port on Processor Unit
Antenna Element 1	No color	GPS ANT 1
Antenna Element 2	Yellow	GPS ANT 2
Antenna Element 3	Red	GPS ANT 3

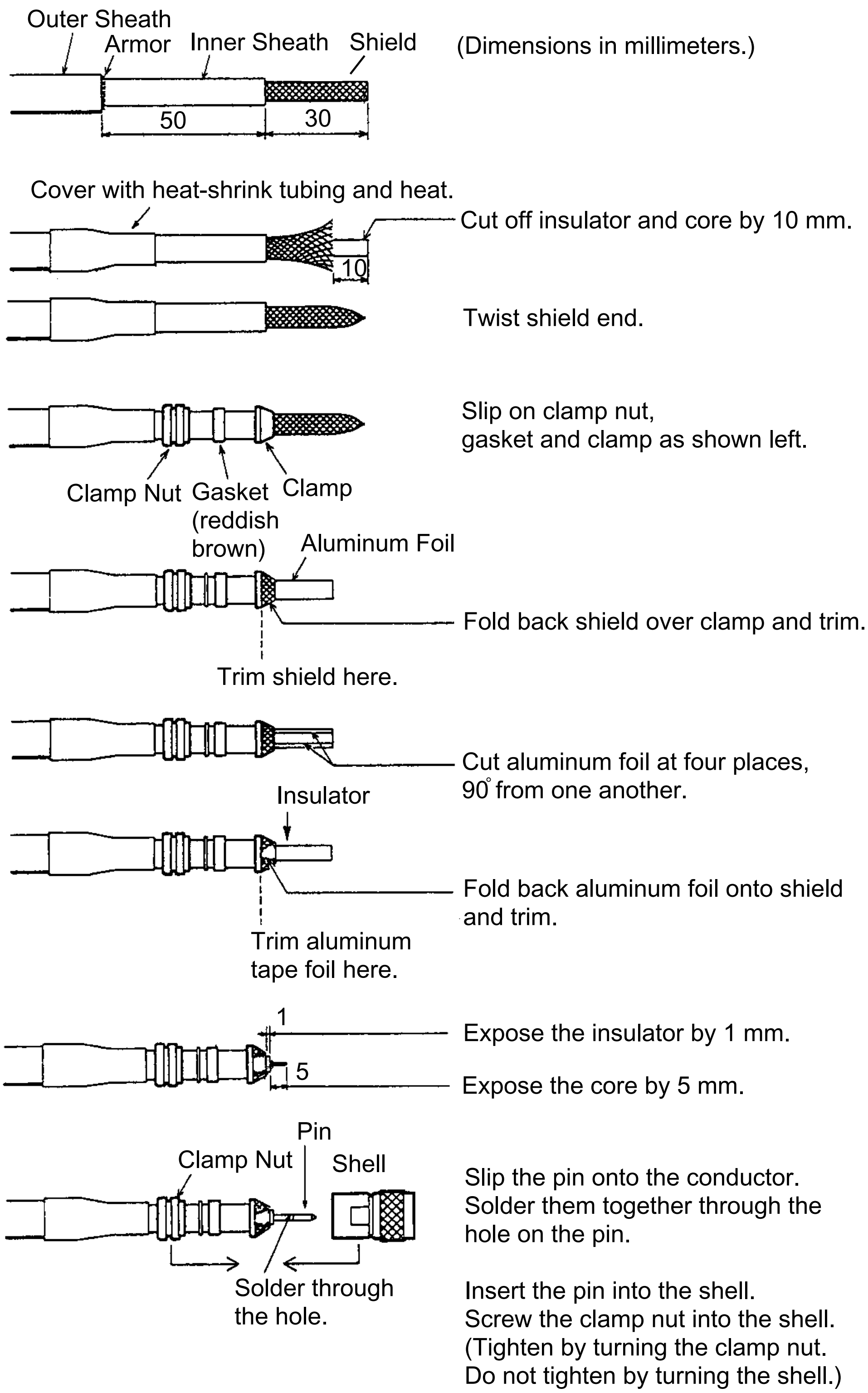
Note 1: Instead of TPPX6-3D2V, three Japan Industrial Standard coaxial cables 3D2V (local supply) or equivalent can be used as antenna cables.



Sectional view of coaxial cable 3D2V

Note 2: The optional antenna cable set (CP20-01700 or CP20-01710, 3 sets) allows you to extend the antenna cable to 30 m or 50 m. See the next page for how to attach the connector.

How to attach connector N-P-8DFB



How to attach connector N-P-8DFB

- Connect the DGPS antenna cable to the BEACON ANT port on the processor unit. The standard cable is 15 m long. With the optional extension cable the cable can be extended to 30 m or 60 m.

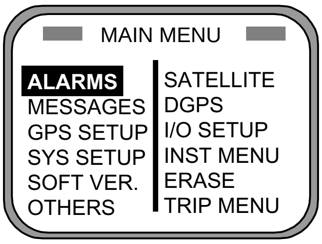
2.6 Initial Settings

Follow the procedures in this section to enter initial settings.

> **⚠ NOTICE**
>
> Improper menu settings may stop output of data and display the message "RATE ERROR." Be sure to enter correct data.

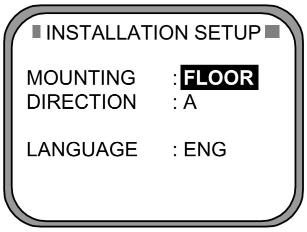
2.6.1 Confirming satellite status; choosing mounting method

1. Turn on the processor unit and press the [MENU] key to show the menu.



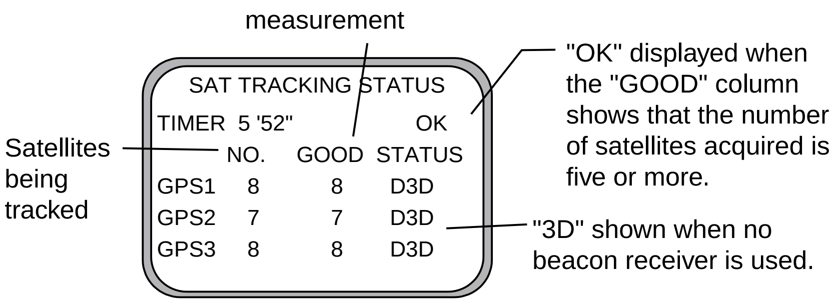
Main menu

2. Use the Omnipad ( ) to choose “INST MENU” and press the [ENT] key.



Installation setup menu

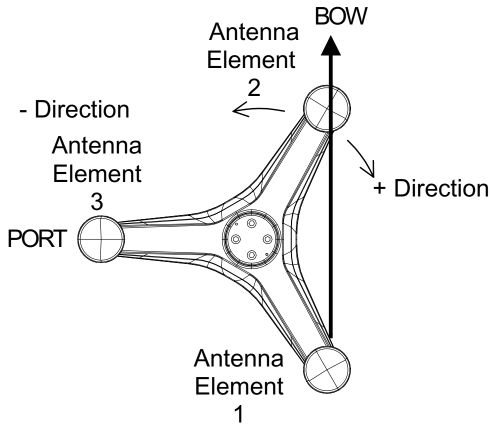
3. Confirm that “MOUNTING” is selected and press the [ENT] key.
4. Use the Omnipad to choose the mounting method: “FLOOR”, “WALL” or “INVERT” as appropriate.
5. Press the [ENT] key.
6. Choose “DIRECTION” and press the [ENT] key.
7. Use the Omnipad to choose mounting direction (“A ”, “B ”, “C” or “D”) as appropriate. Refer to section 2.3.1.
8. Press the [ENT] key.
9. Press the [SAT STATUS] key.



Satellite tracking status display

When the system is turned on for the first time it is in the “cold start” state, which means there is no satellite data (almanac data) stored. In this condition it takes about 20 minutes to find heading, indicated by displaying “OK.” (Once almanac data is stored it takes about five minutes to find heading.) The timer at the top left corner of the screen shows time since power on. If OK is not displayed within 30 minutes after turning on the power, the antenna mounting location may not be suitable. It is suspected that the number of satellites in view is less than five due to signal blockage. Clear the problem and then check status on the status display.

If the heading error is between 5° and 10°, loosen the nut at the center of the antenna unit and adjust antenna orientation, while watching the heading indication on the display.



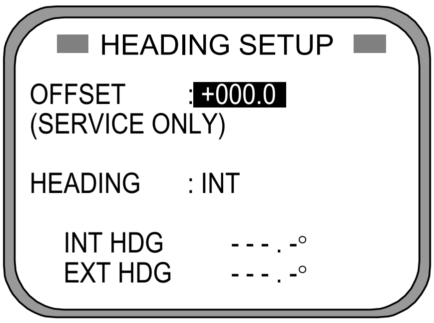
Adjusting antenna orientation

2.6.2 Choosing heading source

Choose the source of heading data as below:

> ⚠ **CAUTION**
>
> **1. Never switch from internal to external heading while the autopilot is in the automatic mode. Change to the manual mode before switching.**
>
> **2. The data of external heading must come from type-approved sensor, in case of SOLAS vessel.**

1. Press the [HDG SETUP] key.



OFFSET : Heading offset. See service manual for instructions. "SERVICE ONLY" means heading offset shown for display only.
HEADING : Select heading source. Choose INT for normal use. If a gyrocomapss is connected for primary means, leaving this equipment as backup, choose EXT.
INT HDG : Bow heading. Includes offset.
EXT HDG : Heading fed from external equipment.

Heading setup menu

2. Use the Omnipad to choose HEADING.
3. Press the [ENT] key.
4. Choose INT or EXT as appropriate. Normally choose INT. If the GPS sensor is not working and a heading sensor such as a gyrocompass is available, choose EXT.

Note: When switching from internal heading to external heading when using an autopilot in the auto mode, set the autopilot in the manual mode BEFORE switching, adjust heading at the autopilot and then switch to the auto mode.

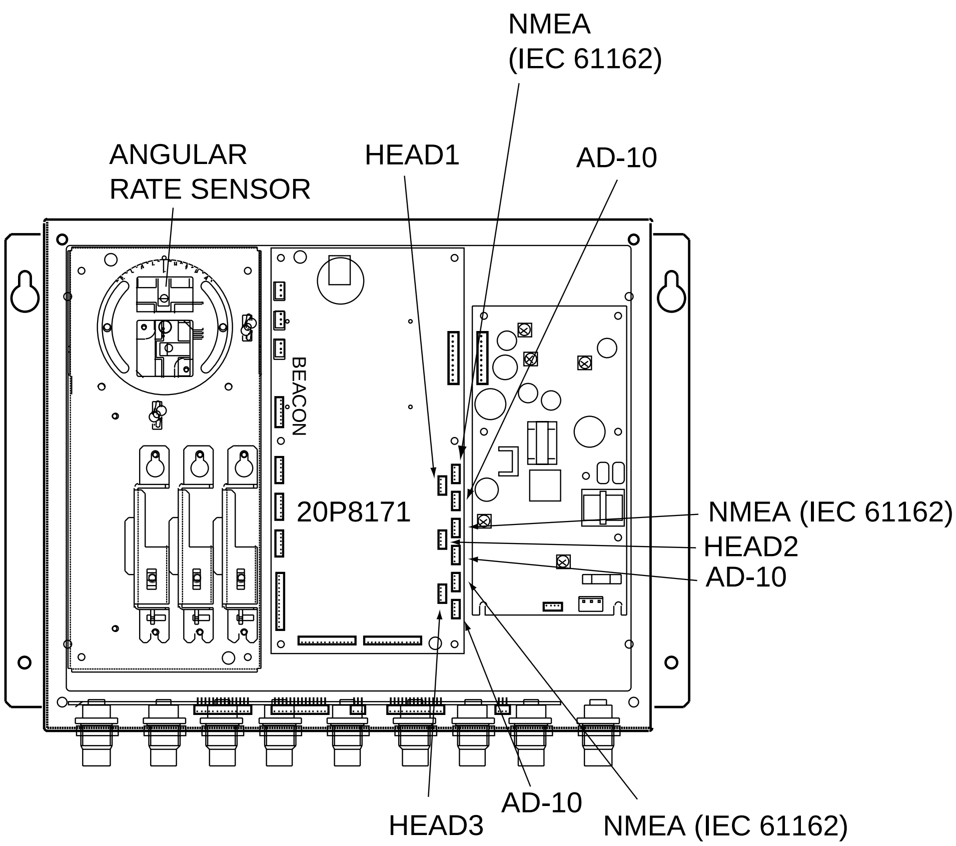
5. Press the [ENT] key.
6. Press the [DISP] key to close the menu.

2.6.3 Heading data format

1. Turn off the processor unit.
2. Unfasten four screws from the processor unit to remove the top cover.
3. Choose the heading format of the equipment connected to the ports HDG OUT 1, HDG OUT 2 and HDG OUT 3 with the jumper wires on the circuit board 20P8171, referring to the table below. The default setting for each port is AD-10.

Jumper wire and format on the circuit board 20P8171

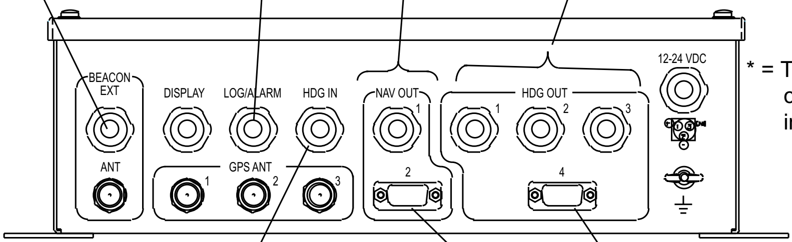
Port	Format	Setting	Remarks
HDG OUT 1	AD-10	J11 < - > J13	NMEA and AD-10 are identified on the circuit board. Choose NMEA for IEC 61162-1 sentences.
	NMEA	J11 < - > J12	
HDG OUT 2	AD-10	J14 < - > J16	
	NMEA	J14 < - > J15	
HDG OUT 3	AD-10	J17 < - > J19	
	NMEA	J 17 < - > J18	



Processor unit, cover opened, top view

2.7 Connection of External Equipment

All external equipment are terminated on the rear panel of the processor unit.



External heading input format and output sentence
AD-10: Header of IEC 61162 data sentence chosen on menu is output.
IEC 61162: When EXT data is output from this equipment, NMEA Header (Identifier) of the external data is output as it is without changes.

Processor unit, rear view

2.8 Installing the DGPS Beacon Receiver Kit

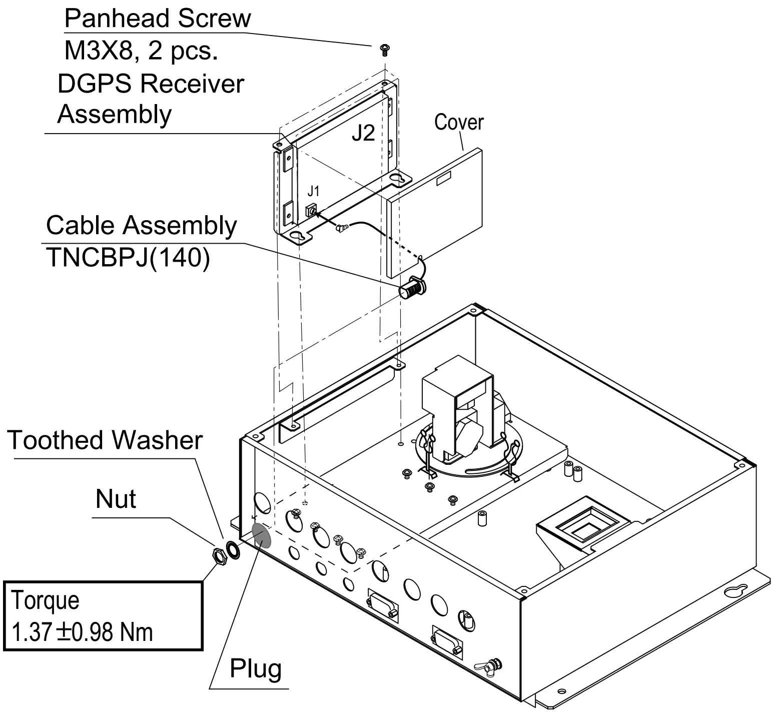
The optional DGPS beacon receiver provides DGPS capability. The beacon receiver assy. is installed in the processor unit. A DGPS antenna is necessary.

DGPS Beacon Receiver Kit
Type: GR-7001-K Code No. 000-041-738

Name	Type	Code No.	Qty	Remarks
Antenna	GR-8	000-040-660	1	
Hose Clamp	SS7200N	000-570-239	2	
Spring Washer	M10	000-864-261	1	
DGPS Receiver Assy.	SC-601	004-377-860	1	
Cable Assy.	TNCBPJ(140)	000-143-748	1	w/toothed washer and nut
PH Connector	20-061(7-6P)	004-377-770	1	
Pan Head Screw	M3X8	000-881-404	4	
DGPS Station List	J49-80010	000-808-435	1	
Whip Antenna	FAW-1.2	000-130-046	1	1.2 m
	04S4176	000-112-845		2.6 m

Procedure

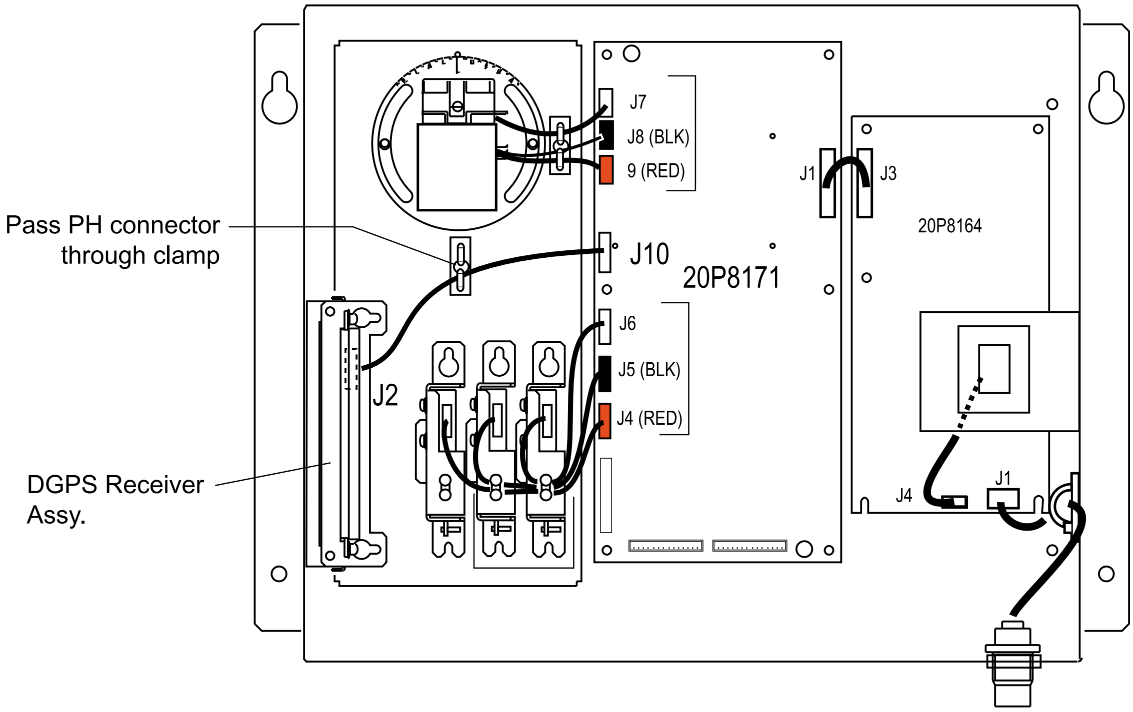
1. Open the top cover processor unit.
2. Open the cover of the DGPS receiver assembly.
3. Connect the cable TNCBPJ(140) to J1 on the DGPS receiver assembly.
4. Remove the plug at the rear of the processor unit.
5. Pass the cable TNCBPJ(140) through the hole made at step 4 and fasten it with the toothed washer and nut.
6. Fasten the DGPS receiver assembly at the location shown below.



Processor unit, cover removed, top view

7. Connect the 6P connector of the PH connector 20-061(7-6P) to J2 on the DGPS receiver assy.
8. Connector the 7P connector of the PH connector 20-061(7-6P) to J10 on the circuit board 20P8171.

9. Fix the PH connector assy. with a clamp as shown in the illustration below.

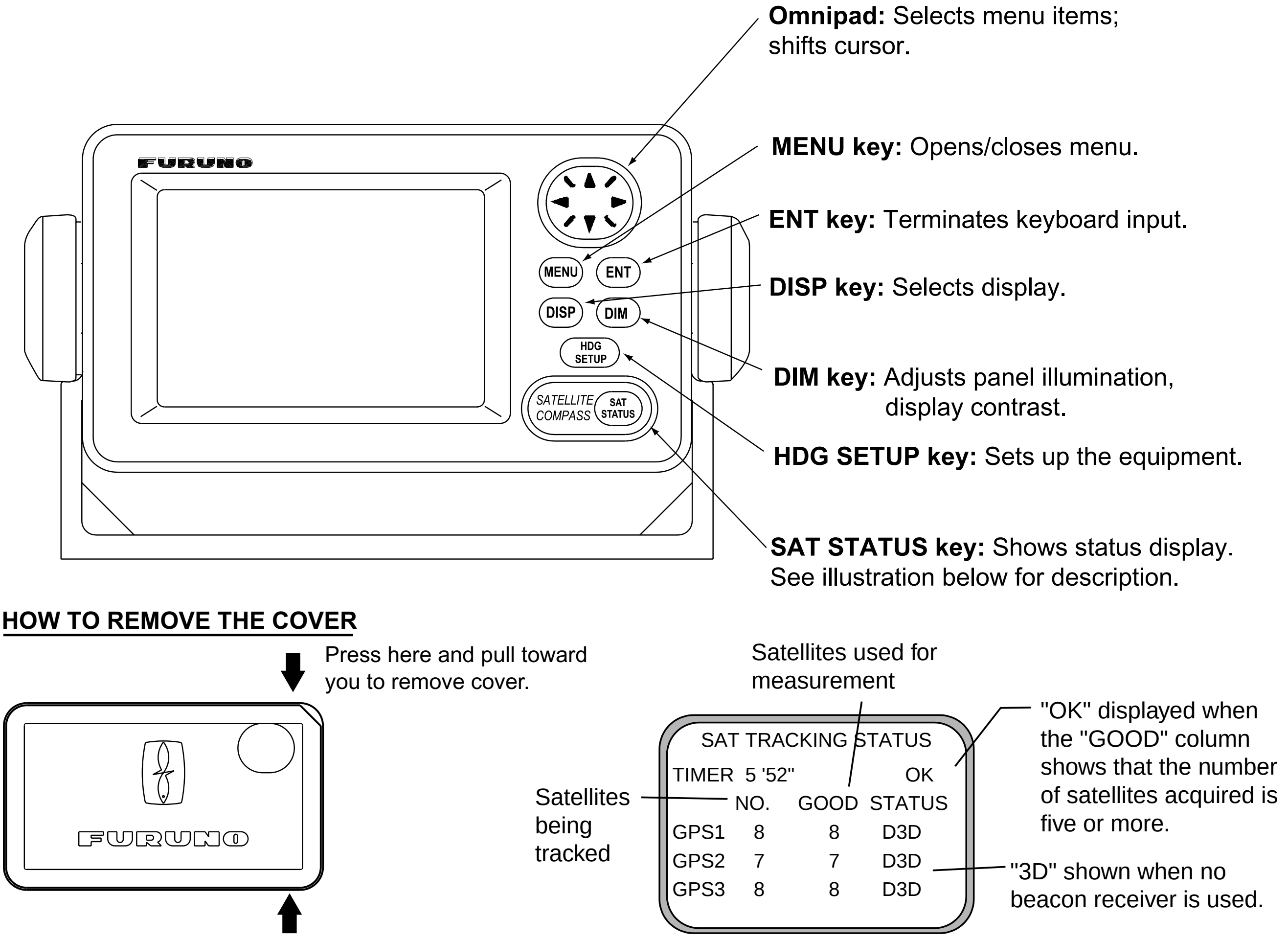


Processor unit, cover removed, top view

10. Close the top cover of the processor unit.
11. Mount the DGPS antenna and whip antenna, referring to section 2.2.

3 OPERATION

3.1 Controls



Display unit

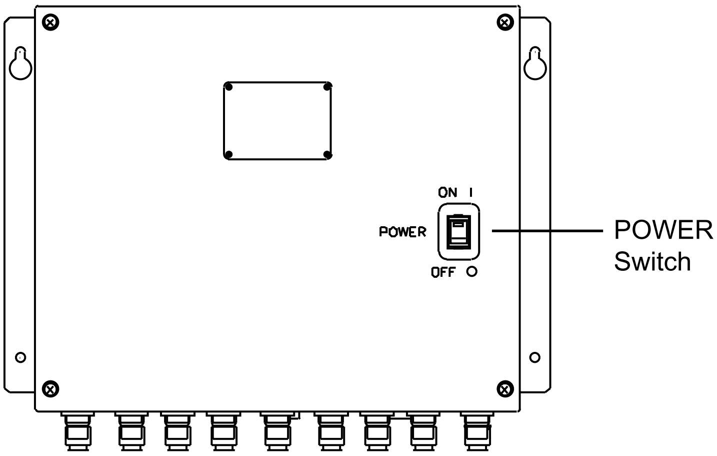
⚠ CAUTION

Reduced accuracy may occur in case of unfavorable satellite constellation, worsened HDOP, etc.

Always confirm position against other navigation devices to verify reliability.

3.2 Turning the Power On/Off

Use the power switch on the processor unit to turn the power on and off.



Processor unit

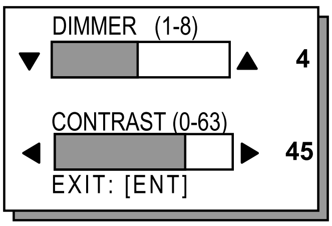
The display starts up with the last-used display.

Note 1: Turn on external equipment <u>**AFTER**</u> the SC-120 is showing reliable heading data, to prevent heading output error.

Note 2: The display flashes when backup heading data is used.

3.3 Panel Illumination, Display Contrast

1. Press the [DIM] key.



Dialog box for adjustment of panel illumination, display contrast

2. Press ▲ or ▼ on the Omnipad to adjust panel illumination.
3. Press ◄ or ► on the Omnipad to adjust display contrast.
4. Press the [ENT] key.

3.4 Choosing a Display

Use the [DISP] key to show a display desired. Each press of the key changes the display in the sequence shown in the paragraph below.

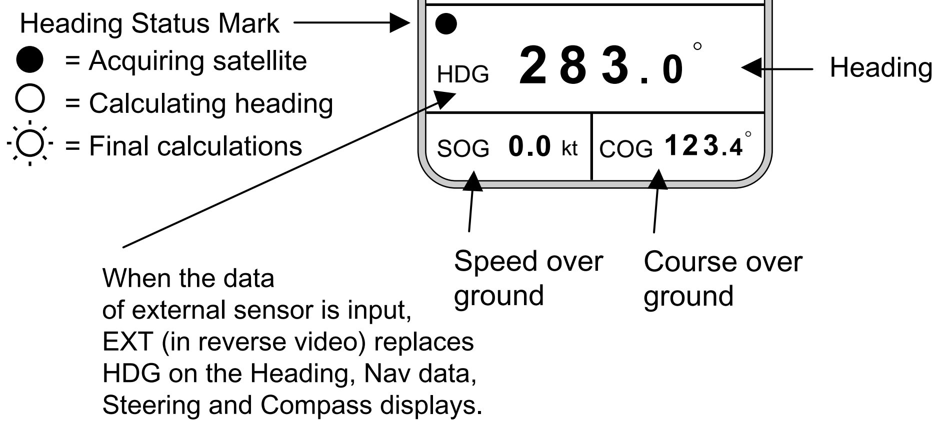
3.4.1 Description of displays

Heading display

The heading display shows heading, course, speed, date, time and position-fixing method. The heading status mark changes in the sequence shown below. The "final calculations" mark disappears after heading becomes reliable, which is approximately 90 seconds after that mark appears.

Position-fixing status indications

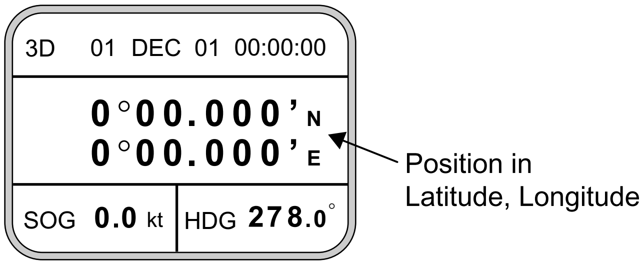
2D	2D GPS position fix
3D	3D GPS position fix
D2D	2D DGPS position fix
D3D	3D DGPS position fix
SIM	Simulation mode



Heading display

Nav data display

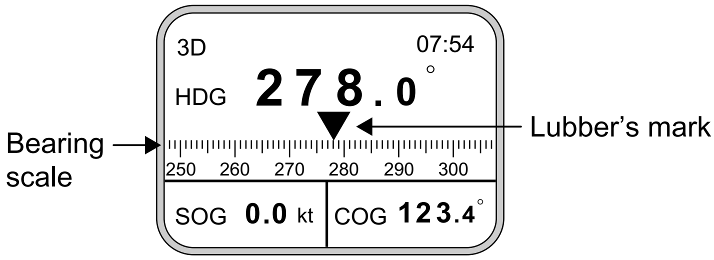
The nav data display shows position in latitude and longitude, course, speed, date, time and position-fixing method.



Nav data display

Steering display

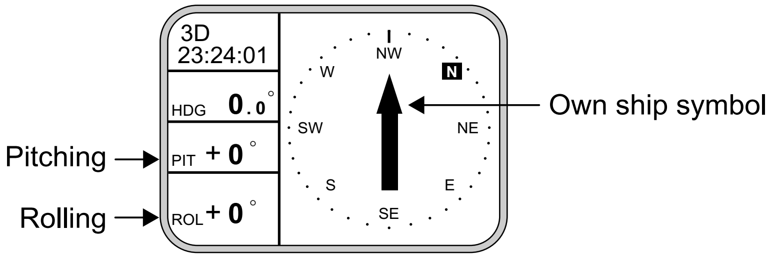
The steering display mainly shows heading, in digital and analog form. The own ship mark points to heading on the bearing scale.



Steering display

Compass display

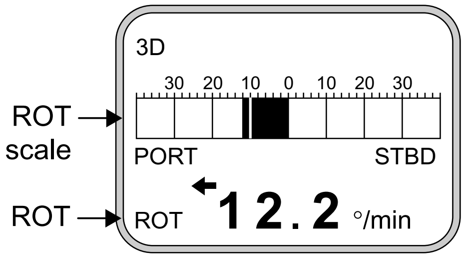
The compass display shows heading by compass direction, pitch and roll The compass rose rotates with heading.



Compass display

ROT (Rate-of-Turn) display

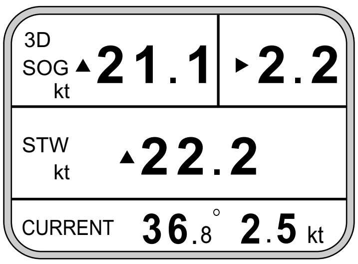
The ROT display provides digital and analog indications of rate of turn.



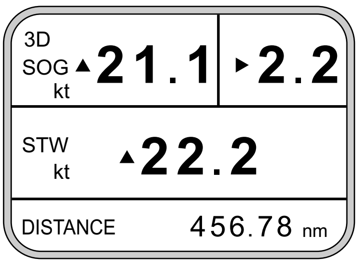
ROT display

Set and Drift display, Distance Run display

Depending on the setting of DISTANCE DISP on the TRIP menu, the Set and Drift display or the Distance Run display is shown. The Set and Drift display requires the Doppler Speed Log DS-80 and it shows current direction and speed.



Set and Drift display



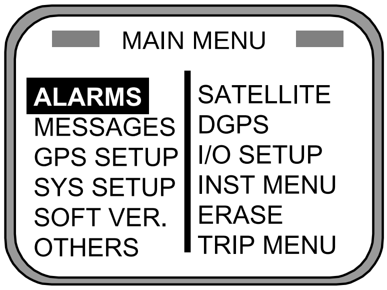
Speed and Distance Run display

Set and drift display, distance run display

3.5 Alarms

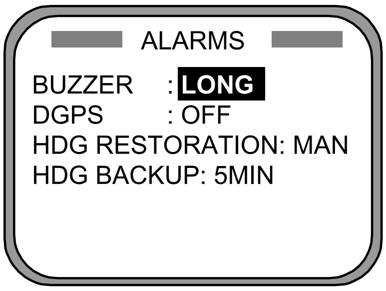
The SC-120 can alert you with audio and visual alarms when GPS data and DGPS data are lost. To set the alarm mode;

1. Press the [MENU] key to show the menu.



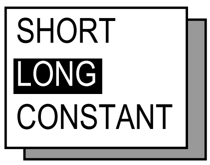
Main menu

2. Choose ALARMS and press the [ENT] key.



Alarm menu

3. Press the [ENT] key.



Alarm menu, GPS buzzer options

4. Use ▲ or ▼ on the Omnipad to choose buzzer type desired.

   SHORT: Two short beeps
   LONG: Three long beeps
   CONSTANT: Continuous beep

5. Press the [ENT] key.
6. Select DGPS, HDG RESTORATION or HDG BACKUP as appropriate.

   DGPS: Turns on/off DGPS alarm.

   HDG RESTORATION: Choose how to restore GPS signal, automatically or manually.

   HDG BACKUP: Choose how long to wait before stopping output of heading, when GPS signal is lost.

7. Press the [ENT] key.



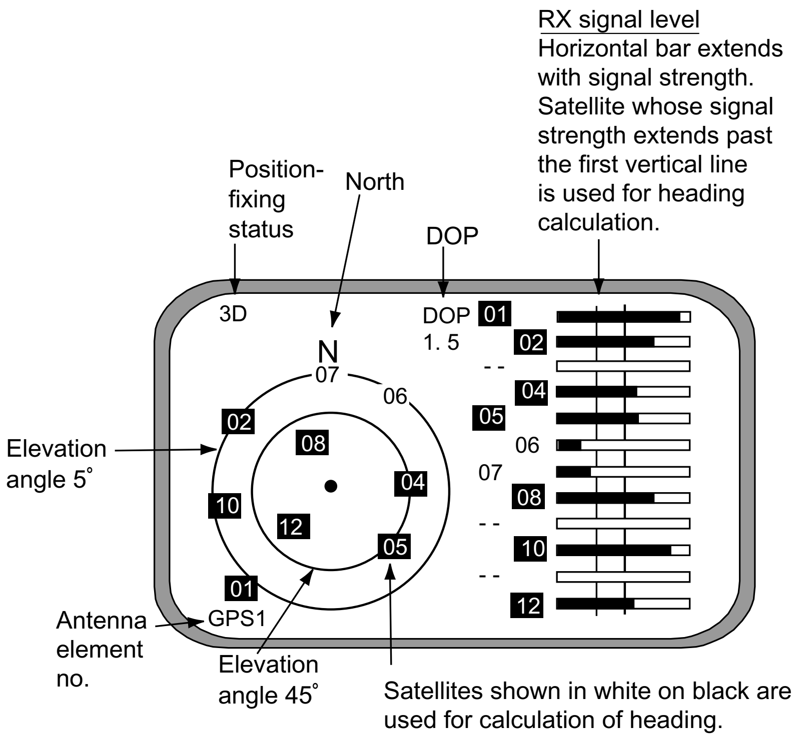
Alarm menu, DGPS buzzer options

7. Select appropriate option. For HDG BACKUP, use ▲ or ▼ on the Omnipad to set time, from 1 to 5 (minutes).
8. Press the [ENT] key.
9. Press the [DISP] key to close the menu.

3.6 Confirming Satellite Status

You can check the receiving condition of each antenna element as follows:

1. Press the [MENU] key to open the menu.
2. Choose SATELLITE and press the [ENT] key.



Satellite status display

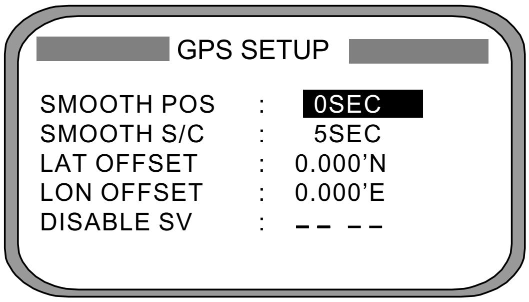
3. Use ◄ or ► on the Omnipad to choose antenna element for which to confirm receiving status
4. Press the [DISP] key to close the menu.

3.7 GPS Setup

The GPS SETUP menu smooths position and course, averages speed, applies position offset, and deactivates unhealthy satellites.

3.7.1 Displaying the GPS setup menu

1. Press the [MENU] key to open the menu.
2. Choose GPS SETUP and press the [ENT] key.



GPS SETUP menu

3.7.2 GPS SETUP menu description

SMOOTH POS (Smoothing position)

When the DOP (Dilution of Precision, the index for position-fixing accuracy) or receiving condition is unfavorable, the GPS fix may change randomly, even if the vessel at anchor. This change can be smoothed by averaging a number of GPS fixes. The setting range is from 0 (no smoothing) to 999 seconds. The setting range is from 0 (no smoothing) to 999 seconds, and the default is 5 s, which is good for rolling period o 5-8 s. The higher the setting the more smoothing. However, too high a setting slows updating of position. “0” is the default setting; increase the setting if the GPS fix fluctuates largely.

SMOOTH S/C (Smoothing speed/course)

Ship’s speed and course are directly measured by receiving GPS satellite signals, independent of positions. The data varies with receiving conditions and other factors. You can reduce this random variation by increasing the smoothing. The higher the setting the more that speed and course are smoothed. If the setting is too high, however, the follow-up to actual values gets slower. The setting range is from 0 (no smoothing) to 999 seconds.

LAT/LON OFFSET (L/L position offset)

If GPS fixes are erroneous while at anchor, enter a position offset to compensate for position error. Consult a nautical chart to determine latitude and longitude differences between the chart and GPS display. Enter that value as the offset.

DISABLE SV (Disable satellite)

Every GPS satellite is broadcasting abnormal satellite number(s) in its Almanac, which contains general orbital data about all GPS satellites. Using this

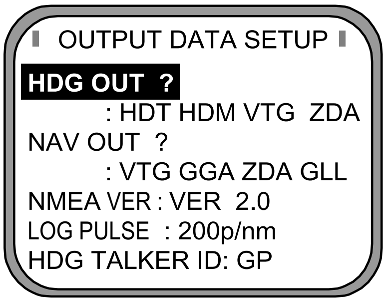
information, the GPS receiver automatically eliminates any malfunctioning satellite from the GPS satellite schedule. However, the Almanac sometimes may not contain this information. If you hear of an inoperative satellite you can disable it manually. Enter satellite number in two digits and press the [ENT] key. To restore a satellite, enter “00”.

3.8 Output Data

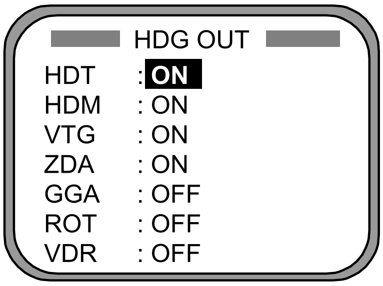
3.8.1 Heading

Heading data is output from the HDG OUT port on the processor unit, in IEC 61162-1 format. For further details about input/output data ports see page A-7.

1. Press the [MENU] key to open the menu.
2. Choose I/O SETUP and press the [ENT] key to show the OUTPUT DATA SETUP menu.
3. Press the [ENT] key to show the HDG OUT display.
   - HDT: True heading (required for radar, AIS, ECDIS, etc.)
   - HDM: Magnetic heading
   - VTG: Course over ground and ground speed
   - ZDA: Time and date
   - GGA: Global positioning system (GPS) fix data
   - ROT: Rate-of-turn data
   - VDR: Set and drift
4. Choose item desired and press the [ENT] key.
5. Choose ON or OFF as appropriate and press the [ENT] key.
6. Press the [DISP] key to close the menu.



OUTPUT DATA SETUP menu



HDG OUT display

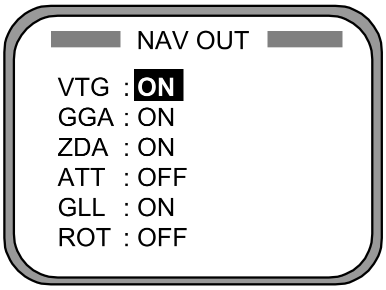
Note 1: Some boaters may want magnetic heading when the boat is fitted with only a magnetic compass without correction of deviation and variation. HDM is obtained in this equipment by adding the magnetic variation to HDT automatically.

Note 2: VBW and VHW sentences must be input at the HDG IN port to output the VDR sentence.

3.8.2 Navigation data

Choose the data to output from the NAV OUT port as follows:

1. Press the [MENU] key.
2. Choose I/O SETUP and press the [ENT] key.
3. Choose “NAV OUT?” and press the [ENT] key.



NAV OUT menu

VTG: Course over ground and ground speed
GGA: Global positioning system (GPS) fix data
ZDA: Time and date
ATT: True heading, pitching, rolling
GLL: Geographic position (latitude and longitude)
ROT: Rate-of-turn data

4. Choose item desired and press the [ENT] key.



5. Choose ON or OFF as appropriate and press the [ENT] key.
6. Press the [DISP] key to close the menu.

3.8.3 Interface

Normally choose IEC for supplying heading information to AIS and radars. If you are unsure of the version your equipment uses, try all three and choose the one which successfully outputs data.

1. Press the [MENU] key to open the menu.
2. Choose I/O SETUP and press the [ENT] key.
3. Choose NMEA VER and press the [ENT] key.



Format selection window

4. Choose VER 1.5 or VER 2.0 as appropriate and press the [ENT] key.

3.8.4 Log pulse

This equipment provides SOG (speed over ground) in high accuracy. It converts an SOG value to a closure signal and outputs at the rate of 200 or 400 pulses/nm.

1. Press the [MENU] key.
2. Choose I/O SETUP and press the [ENT] key.
3. Choose LOG PULSE and press the [ENT] key.

200p/nm
400p/nm

Log pulse rate selection window

4. Choose 200 p/nm or 400 p/nm as appropriate and press the [ENT] key.
5. Press the [DISP] key to close the menu.

3.8.5 Talker identifier mnemonics

Choose the heading talker ID for the output data sentence HDT and HDM as follows:

1. Press the [MENU] key.
2. Choose I/O SETUP and press the [ENT] key.
3. Choose HDG TALKER and press the [ENT] key.

GP
HE
HN
HC

Heading talker selection window

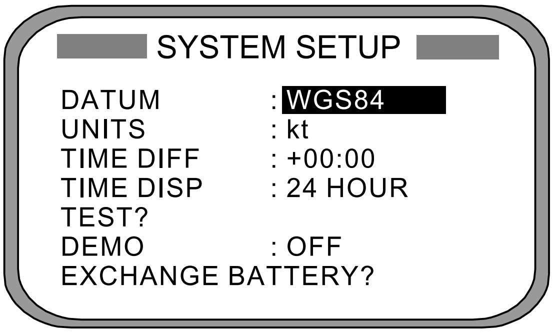
4. Choose GP, HE, HN or HC as appropriate and press the [ENT] key. Choose GP normally. If an external gyrocompass is to be used, choose HC.
   GP: GPS Navigator
   HE: North-seeking gyrocompass
   HN: Non-north seeking gyrocompass
   HC: Gyrocompass
5. Press the [DISP] key to close the menu.

3.9 System Setup

3.9.1 Geodetic data

Your unit is preprogrammed to recognize most of the major chart systems of the world. Although the WGS-84 system (default setting) is the GPS standard, other categories of charts in other datum still exist. Match the GPS datum with the chart system.

1. Press the [MENU] key to open the menu.
2. Choose SYS SETUP and press the [ENT] key.



SYSTEM SETUP menu

3. Confirm that the cursor is selecting DATUM and press the [ENT] key.
4. Choose WGS84 (GPS standard), WGS72 or OTHER according to the nautical chart you use and press the [ENT] key.
5. If you chose WGS72 or WGS84, press the [DISP] key to finish. For OTHER, go to step 6.
6 Press the [ENT] key.
7. Use the Omnipad to enter chart number, referring to the geodetic chart list on page A-2. Choose location with ◄ or ►; change value with ▲ or ▼.
8. Press the [ENT] key.
9. Press the [DISP] key to close the menu.

3.9.2 Units of measurement

Distance/speed can be displayed in nautical miles/knots, kilometers/kilometers per hour, or miles/miles per hour.

1. Press the [MENU] key to open the menu.
2. Choose SYS SETUP and press the [ENT] key.
3. Choose UNITS.
4. Press the [ENT] key.
5. Choose unit of measurement combination desired; kt, km/h, mi/h.
6. Press the [ENT] key.
7. Press the [DISP] key to close the menu.

3.9.3 Using local time

GPS uses UTC time. If you would rather use local time, enter the time difference (range: -13:30 to +13:30) between local time and UTC.

1. Press the [MENU] key to open the menu.
2. Choose SYS SETUP and press the [ENT] key.
3. Choose TIME DIFF and press the [ENT] key.
4. Press ▲ or ▼ to display + or – as appropriate.
5. Enter time difference with the Omnipad. Choose digit with ◄ or ►; change value with ▲ or ▼.
6. Press the [ENT] key.
7. Press the [DISP] key to close the menu.

3.9.4 Time format

Time can be displayed in 12 hour or 24 hour format.

1. Press the [MENU] key to open the menu.
2. Choose SYS SETUP and press the [ENT] key.
3. Choose TIME DISP and press the [ENT] key.
4. Choose 12HOUR or 24HOUR as appropriate and press the [ENT] key.
5. Press the [DISP] key to close the menu.

3.9.5 Demonstration mode

The demonstration mode provides simulated operation of the equipment.

1. Press the [MENU] key to open the menu.
2. Choose SYS SETUP and press the [ENT] key.
3. Choose DEMO and press the [ENT] key.
4. Choose ON or OFF as appropriate and press the [ENT] key.
5. Press the [DISP] key to close the menu.

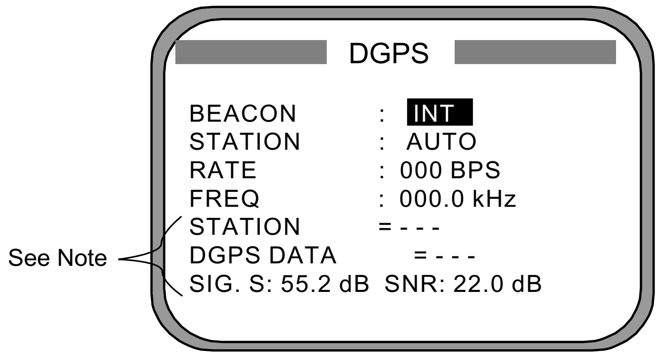
The indication SIM appears at the top of the screen when the demonstration mode is active. When the demonstration mode is first made active, SIMULATION MODE appears when the power is turned on and it is erased when any key is pressed.

3.10 DGPS Setup

The internal type DGPS receiver is set at the factory for automatic reception. If you want to set it manually or are using an external beacon receiver, follow the procedure below. Note that DGPS increases position accuracy fix but it does not affect heading accuracy.

3.10.1 Manual DGPS setup

1. Press the [MENU] key to open the menu.
2. Choose DGPS and press the [ENT] key.



DGPS menu

DGPS Data

STATION: Shows GOOD or NG.

DGPS DATA: Shows GOOD or NG.

SIG. S = Signal Strength. A figure between 0 and 99 is shown. The higher the figure the stronger the beacon signal.

SNR = Signal to Noise Ratio. A figure between 1 and 22 is shown. When your boat is in the service area of a beacon station, SNR should be 21 or 22. If the figure is below 18 the position will be inaccurate. If this happens, check for radar interference, poor ground and generator noise on own ship.

3. The cursor is on the BEACON field. Press the [ENT] key.

OFF
INT
EXT

Beacon receiver selection window

4. Choose appropriate option and press the [ENT] key.

   INT: For internal DGPS beacon receiver.
   EXT: For external DGPS beacon receiver
   OFF: Disables DGPS function. When OFF is selected it takes about one minute to find GPS position.

   Note: When connecting a FURUNO external DGPS beacon receiver (such as the GR-80) to the SC-120, turn the GR-80's remote function on to set up the beacon receiver with commands from the SC-120. Also set the external DGPS beacon receiver as follows: Byte Format, 8-6; First Bit, LSB; Parity Bit, None; Stop Bit, 1; Bit Rate, 8.

5. Press the [ENT] key.
6. Choose DGPS beacon station selection method: AUTO, MANUAL or LIST.

   AUTO: Automatically searches for best DGPS beacon station.
   MANUAL: Manually enter DGPS beacon station specifications in the RATE and FREQ fields, referring to a DGPS beacon station list.
   LIST: Lists five of the closest DGPS beacon stations, including user-programmed stations.

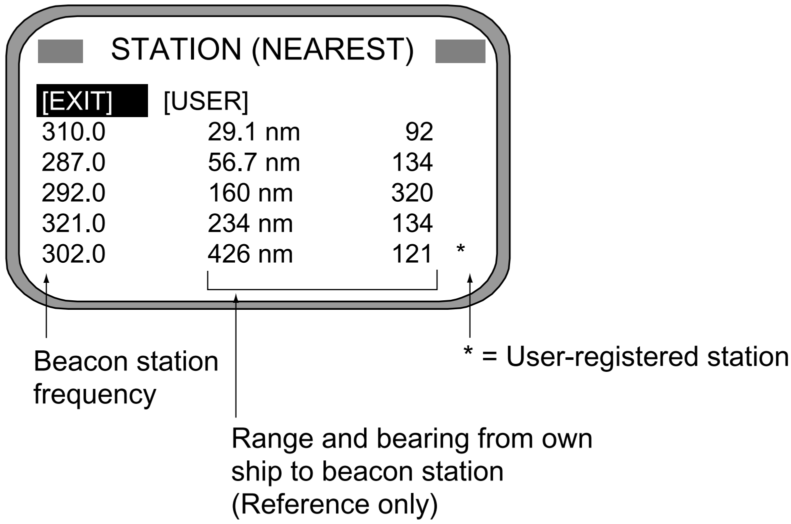
7. Press the [ENT] key. If you selected AUTO, no further operation is required; press the [DISP] key to close the menu. For MANUAL or LIST follow the appropriate procedure below.

   MANUAL

   a) The cursor is now on the RATE field. Press the [ENT] key.
   b) Choose the data rate of the DGPS beacon station to be used, among 50, 100 or 200 bps. Press the [ENT] key.
   c) The cursor is now on the FREQ field. Press the [ENT] key.
   d) Enter the transmission frequency of the DGPS beacon station to be used and press the [ENT] key.

LIST

a) The following display appears after pressing the [ENT] key at step 7.



Beacon station display

b) Choose desired station with the Omnipad.

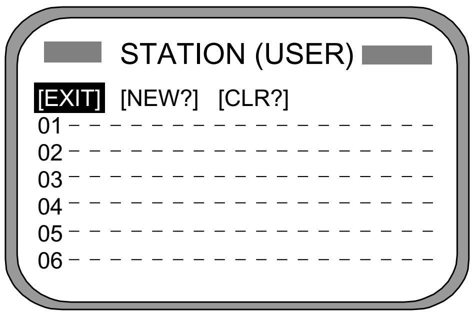
c) Press the [ENT] key.

8. Press the [DISP] key to close the menu.

3.10.2 Programming user beacon stations

The user may program 20 DGPS beacon stations from which to use in selection of DGPS beacon station. Whenever a new station comes into operation, you can add it to the list.

1. Press the [MENU] key to open the menu.
2. Choose DGPS and press the [ENT] key.
3. Choose STATION and press the [ENT] key.
4. Choose LIST and press the [ENT] key.
5. Choose USER and press the [ENT] key to show the STATION (USER) display.



STATION (USER) display

6. Choose “NEW?” and press the [ENT] key.

```
NEW USER CHANNEL

FREQ      :  310.0kHz
RATE      :  200BPS
LAT       :  37°59'N
LON       :  133°00'E

EXIT?   SAVE?
```

NEW USER CHANNEL display

Note: For steps 7-10 use the Omnipad to enter data. Choose location with ◄ or ►; change value with ▲ or ▼.

7. Press the [ENT] key, enter frequency of the station, and press the [ENT] key.
8. Press the [ENT] key, enter baud rate of the station, and press the [ENT] key.
9. Press the [ENT] key, enter latitude of the station, and press the [ENT] key.
10. Press the [ENT] key, enter longitude of the station, and press the [ENT] key.
11. Choose "SAVE?" and press the [ENT] key.
12. Press the [DISP] key to close the menu.

3.10.3 Editing user beacon stations

1. Press the [MENU] key to open the menu.
2. Choose DGPS and press the [ENT] key.
3. Choose STATION and press the [ENT] key.
4. Choose LIST and press the [ENT] key.
5. Choose USER and press the [ENT] key.
6. Choose a station from the list and press the [ENT] key. The display looks something like the one below.

```
FREQ      :  310.0kHz
RATE      :  200BPS
LAT       :  37°59'N
LON       :  133°00'E

EXIT   SAVE?   ERASE?
```

Display for editing user channels

7. Choose item, press the [ENT] key, edit data, and press the [ENT] key.
8. Choose "SAVE?" and press the [ENT] key.
9. Press the [MENU] key twice to finish.

3.10.4 Erasing individual user stations

1. Press the [MENU] key to open the menu.
2. Choose DGPS and press the [ENT] key.
3. Choose STATION and press the [ENT] key.
4. Choose LIST and press the [ENT] key.
5. Choose USER and press the [ENT] key.
6. Choose a channel from the list and press the [ENT] key.
7. Choose “ERASE?”.
8. Press the [ENT] key to erase channel selected.

3.10.5 Erasing all user beacon stations

1. Press the [MENU] key to open the menu.
2. Choose DGPS and press the [ENT] key.
3. Choose STATION and press the [ENT] key.
4. Choose LIST and press the [ENT] key.
5. Choose USER and press the [ENT] key.
6. Choose CLR? and press the [ENT] key. You are asked if it is all right to erase all user channels.



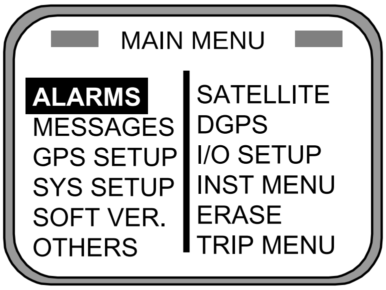
Prompt for erasure of all user channels

7. Choose YES and press the [ENT] key to erase all user channels.

3.11 OTHERS Menu

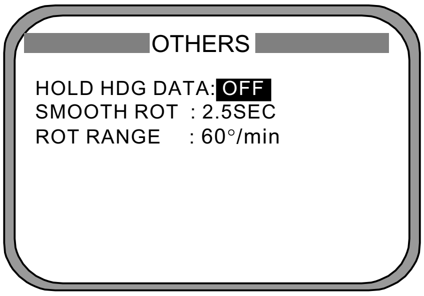
The OTHERS menu chooses whether to output last-used heading data, and smooths rate of turn (rate-of-turn meter required).

1. Press the [MENU] key to display the main menu.



Main menu

3. Choose OTHERS and press the [ENT] key.



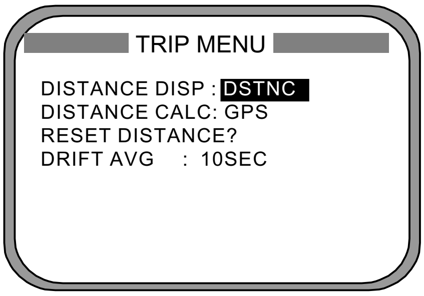
Others menu

4. Choose HOLD HDG DATA and press the [ENT] key.
5. Choose ON to use, at power on, last-used heading until current heading is calculated. Last-used heading flashes to inform that it is unreliable.
6. Press the [ENT] key.
7. Choose SMOOTH ROT and press the [ENT] key.
8. Use the Omnipad to enter smoothing time. Choose location with ◄ or ►; change value with ▲ or ▼.
9. Press the [ENT] key.
10. Choose ROT RANGE and press the [ENT] key.
11. Choose the range of the ROT graph: 30, 60 or 90 and press the [ENT] key.
12. Press the [DISP] key to close the menu.

3.12 TRIP Menu

The TRIP menu chooses the indication to show on the Speed display, distance source; resets distance run (see para. 3.13) and smooths the tide drift indication.

1. Press the [MENU] key to display the main menu.
2. Choose TRIP MENU and press the [ENT] key.



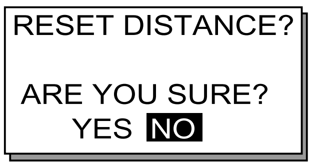
TRIP menu

1. Choose DISTANCE DISP and press the [ENT] key.
2. Choose what to display on the Speed display; distance run (DSTNC) or tide direction and speed (DRIFT). Press the [ENT] key.
3. Choose DISTANCE CALC and press the [ENT] key.
4. Choose the source for distance run; GPS, VLW (distance traveled through water) or VBW (Dual ground/water speed). (VLW requires DS-80 type Doppler speed log and VBW requires Current indicator or Doppler speed log.) Press the [ENT] key.
5. Choose DRIFT AVG. and press the [ENT] key.
6. If tide current and speed data is unstable, enter a smoothing figure to stabilize the data. The higher the figure the more smoothed the data. A setting between 0 (no smoothing) and 9999 is available.
7. Press the [ENT] key.
8. Press the [DISP] key to close the menu.

3.13 Resetting Distance Run

The distance run may be reset to zero as below when the source of distance run is GPS or VBW.

1. Press the [MENU] key to display the main menu.
2. Choose TRIP MENU and press the [ENT] key.
3. Choose RESET DISTANCE and press the [ENT] key.



RESET DISTANCE prompt

4. Choose YES and press the [ENT] key.
5. Press the [DISP] key to close the menu.

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4 MAINTENANCE, TROUBLESHOOTING

⚠ WARNING

ELECTRICAL SHOCK HAZARD
Do not open the equipment.

Only qualified personnel should work inside the equipment.

4.1 Preventive Maintenance

Regular maintenance is important for good performance. A maintenance program should be established and should include the following points.

- Check connectors and ground terminal on the processor unit and display unit for tightness.
- Check ground terminal for rust. Clean or replace as necessary.
- Check for water leakage in the antenna cable. Replace if necessary.
- Remove dust and dirt from the display unit (including LCD) and processor unit with a dry, soft cloth. Wipe the LCD softly to prevent scratching. Do not use chemical cleaners for cleaning - they can remove paint and markings.

4.2 Troubleshooting

This section provides basic troubleshooting procedures which the user may follow to restore normal operation.

Troubleshooting

Symptom	Cause	Remedy
Cannot turn on the power.	Power connector on the processor unit	Firmly connect the power connector.
	Power supply failure	Check the power supply.
	Blown fuse	Check the fuse.
Heading indication changes randomly when ship is at anchor or does not change when ship moves.	Sensor trouble	Run the diagnostic test2 to determine the cause.
Heading output from SC-120 does not appear on external equipment.	Connection between SC-120 and external equipment has loosened	Firmly fasten the connector.
	Sensor trouble	Run the diagnostic test1 to determine the cause.

If large hading error occurs or heading indication is frequently interrupted, contact your dealer for advice.

4.3 Diagnostics

Diagnostic test1

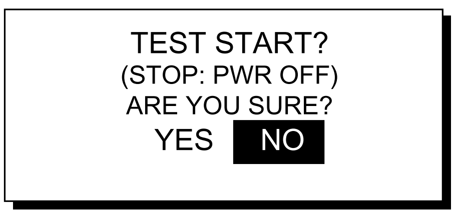
The diagnostic test checks the equipment for proper operation.
Note: Heading is not output during the diagnostic test, and this is communicated with an appropriate message. After completing the diagnostic test, turn the power off and on to update heading data.

1. Press the [MENU] key to open the menu.
2. Choose SYS SETUP and press the [ENT] key.
3. Choose TEST? and press the [ENT] key.



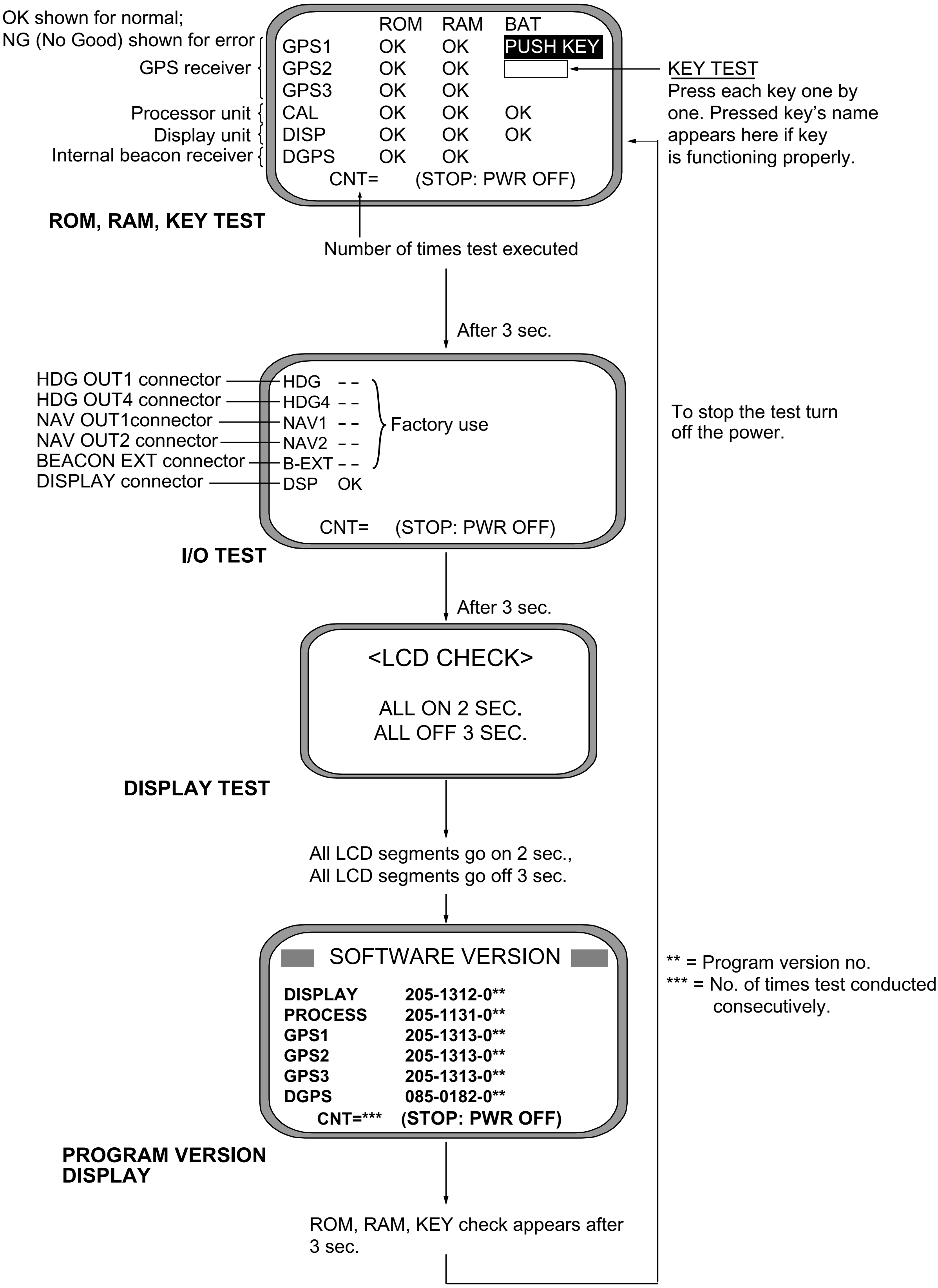
Test menu options

4. Confirm that TEST1 is selected and press the [ENT] key.



Test start prompt

5. Press ◄ to choose YES and press the [ENT] key. The test proceeds in the sequence shown below.



Diagnostic test sequence

6. Turn off the processor unit to quit the diagnostic test1.

Diagnostic test2

If the heading indication changes randomly when ship is at anchor or does not change when the ship moves, run the test2 following the procedure below, with the ship at anchor and satellite signal received.

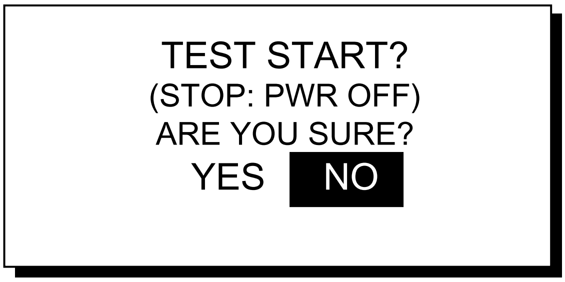
Note: Heading is not output during the diagnostic test, and this is communicated with an appropriate message. After completing the diagnostic test, turn the power off and on to update heading data.

1. Press the [MENU] key to open the menu.
2. Choose SYS SETUP and press the [ENT] key.
3. Choose TEST? and press the [ENT] key.



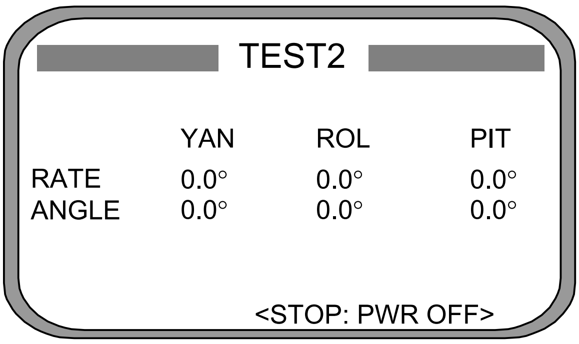
Test menu options

4. Choose TEST2 and press the [ENT] key.



Test start prompt

5. Press ◄ to choose YES and press the [ENT] key.
6. Press the [ENT] key twice. Rate and angle values are 0.0°. If the values increase or decrease markedly (with ship at anchor), suspect rate sensor trouble. Contact your dealer to request service.



TEST2 display

7. Turn off the processor unit to quit the diagnostic test2.

4.4 Program Number

You may display the program number as follows:

1. Press the [MENU] key to open the menu.
2. Choose SOFT VER. and press the [ENT] key.

SOFTWARE VERSION

DISPLAY	205-1312-0**
PROCESS	205-1311-0**
GPS1	205-1313-0**
GPS2	205-1313-0**
GPS3	205-1313-0**
DGPS*	085-0182-0**

* = Blank if no DGPS receiver is connected.
** = Program version no.

Program version no. display

3. Press the [DISP] key to close the program version no. display.

4.5 Clearing Data

You may clear GPS data and system data all at once or individually as follows:

1. Press the [MENU] key to open the menu.
2. Choose ERASE and press the [ENT] key.
3. Choose GPS DATA, SYSTEM DATA or ALL BACKUP DATA (clears GPS and SYSTEM data) as appropriate. One of the following displays appears depending on your selection.

ERASE GPS DATA?
ARE YOU SURE?
YES NO

ERASE ALL BACKUP DATA? (DEFAULT)
ARE YOU SURE?
YES NO

ERASE SYSTEM DATA? (DEFAULT)
ARE YOU SURE?
YES NO

Prompts for erasure of data

4. Press ◄ to choose YES and press the [ENT] key to erase. After data is erased the message “Completed erasing. Turn off the unit.” Is displayed.

   Note: MOUNTING, DIRECTION and LANGUAGE in the INST menu, HDG RESTORATION and HDG BACKUP in the ALARMS menu, STATION in the DPGS menu and OFFSET in the HEADING SETUP menu are not cleared.

5. Turn off and on the power.

4.6 Replacement of Battery

The display unit and processor unit have a battery which stores data when the power is turned off. When the battery voltage is low the message “BATTERY!” appears on the display. Open the message display, by pressing the [MENU] key and choosing “MESSAGES”, to find out which battery’s voltage is low. Have a qualified technician replace the battery, following the procedure below. The life of the batteries is 3-5 years.

Battery Location	Type	Code No.
Display Unit	TZ6580553A	000-139-951
Processor Unit	CR2450-F2ST2	000-133-495

1. Press the [MENU] key to open the menu.
2. Choose SYS SETUP and press the [ENT] key.
3. Choose EXCHANGE BATTERY? And press the [ENT] key.

DISPLAY UNIT

PROCESSOR UNIT

Battery exchange options

4. Choose DISPLAY UNIT or PROCESSOR UNIT as appropriate and press the [ENT] key.

EXCHANGE BATT?
(DISPLAY UNIT)*
ARE YOU SURE?

YES NO

* Or processor unit

Prompt for exchanging battery

5. Press ◄ to choose YES and press the [ENT] key. The following message appears.

READY FOR
BATTERY CHANGE.
TURN OFF THE
UNIT.

Prompt for turning off the power

6. At this time the contents of the RAM are temporarily moved to the flash memory. Turn off the power.
7. Have a qualified technician replace the battery.

4.7 Replacement of Fuse

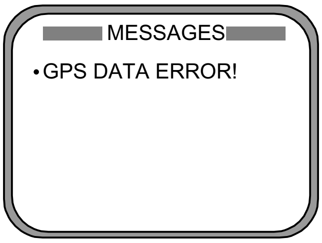
The 3 A fuse on the POWER Board inside the processor unit protects the equipment from overcurrent and reverse polarity of the power supply. If the fuse blows, have a qualified technician check the set and replace the fuse.

> ⚠ **CAUTION**
>
> **Use the proper fuse.**
>
> Use of a wrong fuse can cause fire or damage to the equipment.

4.8 Error Messages

The alarm sounds for equipment error and is accompanied by a flashing exclamation mark (!). Press any key to silence the alarm. The exclamation mark remains on the screen until the cause for error is eliminated. Find the cause for the alarm(s) as follows:

1. Press the [MENU] key to open the menu.
2. Choose MESSAGES and press the [ENT] key.



Message display

3. Press the [DISP] key to close the menu.

Error messages

Error Message	Meaning	Remedy
ABORTING!	GPS heading error continues for one minute. For example, satellite cannot be acquired because of unfavorable environment.	Check for obstruction.
ABORTING CALC!	GPS signal interrupted for one minute	Press any key to try to restore normal operation.
BACKUP ERROR!(DISP)	Corrupted backup data found in display unit at power on.	Default settings are automatically restored.
BACKUP ERROR!(PRCSSR)	Corrupted backup data found at processor unit at power on.	Default settings are automatically restored.

(Continued on next page)

Error messages (con't from previous page)

Error Message	Meaning	Remedy
BATTTERY!	Voltage of battery in display unit or processor unit may be low.	Open the Message Display to see which battery's voltage is low. Have a qualified technician replace the battery.
BATTERY ALM!(DISP)	Voltage of battery in display unit is low.	Have battery replaced at earliest convenience.
BATTERY ALM!(PRCSSR)	Voltage of battery in processor unit is low.	Have battery replaced at earliest convenience.
DATA ERR!	GPS data (from the GPS receiver in the processor unit) is lost for one minute. Heading output is stopped and the heading indication shows "- - -".	Check navigator.
DGPS ERROR!	DGPS data (from the DGPS receiver in the processor unit) is lost for one minute.	Ship may not be within DPGS service area.
GPS DATA ERROR!	GPS data (from the GPS receiver in the processor unit) is lost for one minute. Heading output is stopped and the heading indication shows "- - -".	Conduct diagnostic test and check if NG appears for results for GPS receivers GPS1, GPS2 and GPS3.
GPS NO FIX!	No GPS data.	Check antenna cable.
HDG ERROR!	Heading error	Request service
NO HEADING OUTPUT!	GPS heading error continues for five minutes. In this case heading output is stopped and the heading indication shows "- - -".	Press any key to try to restore normal operation.
RAM ERROR!	RAM problem	Request service.
RATE ERROR!	Data output stopped.	Request service.
ROM ERROR!	ROM problem	Request service.

APPENDIX

Menu Tree

- MENU
  - ALARMS
    - BUZZER (SHORT, ***LONG***, CONSTANT)
    - DGPS (***OFF***, ON)
    - HDG RESTORATION (***MAN***, AUTO)
    - HDG BACKUP (1-5 (MIN), ***5***)
  - SATELLITE
  - MESSAGES
  - DGPS
    - BEACON (***OFF***, INT*, EXT)
    - STATION (***AUTO***, MANUAL, LIST)
    - RATE** (50BPS, 100BPS, 200BPS)
    - FREQ**

    *: INT is default for model with interal beacon receiver.
    **: Available when STATION is set to MANUAL.
  - GPS SETUP
    - SMOOTH POS (0 SEC)
    - SMOOTH S/C (5 SEC)
    - LAT OFFSET (0.000'N)
    - LON OFFSET (0.000'E)
    - DISABLE SV
  - I/O SETUP
    - HDG OUT? (***HDT***, HDM, VTG, ZDA, GGA, ROT, VDR)
    - NAV OUT? (***VTG***, ***GGA***, ***ZDA***, ATT, ***GLL***, ROT)
    - NMEA VER (VER1.5, ***VER2.0***, IEC)
    - LOG PULSE (***200p/nm***, 400p/nm)
    - HDG TALKER ID (***GP***, HE, HN, HC)
  - SYS SETUP
    - DATUM (***WGS84***, WGS72, OTHER 001 (WGS84))
    - UNITS (***kt***, km/h, mi/h)
    - TIME DIFF (+00:00)
    - TIME DISP (12 HOUR, ***24 HOUR***)
    - TEST? (***TEST1***, TEST2)
    - DEMO (***OFF***, ON)
    - EXCHANGE BATTERY? (***DISPLAY UNIT***, PROCESSOR UNIT)
  - INST MENU
    - MOUNTING (***FLOOR***, WALL, INVERT)
    - DIRECTION (***A***, B, C, D)
    - LANGUAGE (***ENG***, JPN)
  - SOFT VER.
  - ERASE
    - GPS DATA?
    - SYSTEM DATA?
    - ALL BACKUP DATA?
  - OTHERS
    - HOLD HDG DATA (***OFF***, ON)
    - SMOOTH ROT (0.1 - 30.0, ***2.5*** (sec))
    - ROT RANGE (30, ***60***, 90 (°/min))
  - TRIP MENU
    - DISTANCE DISP (***DSTNC***, DRIFT)
    - DISTANCE CALC (***GPS***, VLW, VBW)
    - RESET DISTANCE?
    - DRIFT AVG. (0-9999SEC, ***10***)

Default settings in bold italics

Geodetic Chart Codes

001:	WGS84	
002:	WGS72	
003:	TOKYO	: Mean Value (Japan, Korea & Okinawa)
004:	NORTH AMERICAN 1927	: Mean Value (CONUS)
005:	EUROPEAN 1950	: Mean Value
006:	AUSTRALIAN GEODETIC 1984	: Australia & Tasmania
007:	ADINDAN	: Mean Value (Ethiopia & Sudan)
008:		: Ethiopia
009:		: Mali
010:		: Senegal
011		: Sudan
012:	AFG	: Somalia
013:	AIN EL ABD 1970	: Bahrain Is.
014:	ANNA 1 ASTRO 1965	: Cocos Is.
015:	ARC 1950	: Mean Value
016:		: Botswana
017:		: Lesotho
018:		: Malawi
019:		: Swaziland
020:		: Zaire
021:		: Zambia
022:		: Zimbabwe
023:	ARC 1960	: Mean Value (Kenya & Tanzania)
024:		: Kenya
025:		: Tanzania
026:	ASCENSION IS. 1958	: Ascension Is.
027:	ASTRO BEACON ÈOÉ	: Iwo Jima Is.
028:	ASTRO B4 SOR. ATOLL	: Tern Is.
029:	ASTRO POS 71/4	: St. Helena Is.
030:	ASTRONOMIC STATION 1952	: Marcus Is.
031:	AUSTRALIAN GEODETIC 1966	: Australia & Tasmania
032:	BELLEVUE (IGN)	: Efate & Erromango Islands
033:	BERMUDA 1957	: Bermuda Islands
034:	BOGOTA OBSERVATORY	: Columbia
035:	GAUPO INCHAUSPE	: Argentina
036:	CANTON IS. 1966	: Phoenix Islands
037:	CAPE	: South Africa
038:	CAPE CANAVERAL	: Mean Value (Florida & Bahama Islands)
039:	CARTHAGE	: Tunisia
040:	CHATHAM 1971	: Chatham Is. (New Zealand)
041:	CHUA ASTRO	: Paraguay
042:	CORREGO ALEGRE	: Brazil
043:	DJAKARTA (BATAVIA)	: Sumatra Is. (Indonesia)
044:	DOS 1968	: Gizo Is. (New Georgia Is.)
045:	EASTER IS. 1967	: Easter Is.
046:	EUROPEAN 1950 (Cont'd)	: Western Europe
047:		: Cyprus
048:		: Egypt
049:		: England, Scotland, Channel & Shetland Islands
050:		: England, Ireland, Scotland, & Shetland Islands
051:		: Greece
052		: Iran
053:		: Italy, Sardinia
054:		: Italy, Sicily
055:		: Norway & Finland
056:		: Portugal & Spain
057:	EUROPEAN 1979	: Mean Value
058:	GANDAJIKA BASE	: Republic of Maldives
059:	GEODETIC DATUM 1949	: New Zealand
060:	GUAM 1963	: Guam Is.
061:	GUX 1 ASTRO	: Guadalcanal Is.
062:	HJORSEY 1955	: Iceland
063:	HONG KONG 1363	: Hong Kong
064:	INDIAN	: Thailand & Vietnam
065:		: Bangladesh, India & Nepal
066:	IRELAND 1965	: Ireland
067:	ISTS 073 ASTRO 1969	: Diego Garcia
068:	JOHNSTON IS. 1961	: Johnston Is.
069:	KANDAWALA	: Sri Lanka
070:	KERGUELEN IS.	: Kerguelen Is.
071:	KERTAU 1948	: West Malaysia & Singapore
072:	LA REUNION	: Mascarene Is.
073:	L. C. 5 ASTRO	: Cayman Brac Is.
074:	LIBERIA 1964	: Liberia
075:	LUZON	: Philippines (excl. Mindanao Is.)
076:		: Mindanao Is.
077:	MAHE 1971	: Mahe Is.
078:	MARCO ASTRO	: Salvage Islands
079:	MASSAWA	: Eritrea (Ethiopia)
080:	MERCHICH	: Morocco
081:	MIDWAY ASTRO 1961	: Midway Is.
082:	MINNA	: Nigeria
083:	NAHRWAN	: Masirah Is. (0man)
084:		: United Arab Emirates
085:		: Saudi Arabia
086:	NAMIBIA	: Namibia
087:	MAPARIMA, BWI	: Trinidad & Tobago
088:	NORTH AMERICAN 1927	: Western United States
089:		: Eastern United States
090:		: Alaska
091:	:	Bahamas (excl. San Salvador Is.)
092:		: Bahamas, San Salvador Is.
093:		: Canada (incl. Newfoundland Is.)
094:		: Alberta & British Columbia
095:		: East Canada
096:		: Manitoba & Ontario
097:		: Northwest Territories & Saskatchewan
098:		: Yukon
099:		: Canal Zone
100:		: Caribbean
101:		: Central America
102:		: Cuba
103:		: Greenland
104:		: Mexico
105:	NORTH AMERICAN 1983	: Alaska
106:		: Canada
107:		: CONUS
108:		: Mexico, Central America
109:	OBSERVATORIO 1966	: Corvo & Flores Islands (Azores)
110:	OLD EGYPTIAN 1930	: Egypt
111:	OLD HAWAIIAN	: Mean Value
112:		: Hawaii
113:		: Kauai
114:		: Maui
115:		: Oahu
116:	OMAN	: Oman
117:	ORDNANCE SURVEY OF GREAT BRITAIN 1936	: Mean Value
118:		: England
119:		: England, Isle of Man & Wales
120:		: Scotland, & Shetland Islands
121:		: Wales
122:	PICO DE LAS NIVIES	: Canary Islands
123:	PITCAIRN ASTRO 1967	: Pitcairn Is.
124:	PROVISIONS SOUTH CHILEAN 1963	: South Chile (near 53û S)
125:	PROVISIONAL SOUTH AMERICAN 1956	: Mean Value
126:		: Bolivia
127:		: Chile-Northern Chile (near 19ûS)
128:		: Chile-Southern Chile (near 43ûS)
129:		: Columbia
130:		: Ecuador
131:		: Guyana
132:		: Peru
133:		: Venezuela
134:	PUERTO RICO	: Puerto Rico & Virgin Islands
135:	QATAR NATIONAL	: Qatar
136:	QORNOQ	: South Greenland
137:	ROME 1940	: Sardinia Islands
138:	SANTA BRAZ	: Sao Maguel, Santa Maria Islands (Azores)
139:	SANTO (DOS)	: Espirito Santo Is.
140:	SAPPER HILL 1943	: East Falkland Is.
141:	SOUTH AMERICAN 1969	: Mean Value
142:		: Argentina
143:		: Bolivia
144:		: Brazil
145:		: Chile
146:		: Columbia
147:		: Ecuador
148:		: Guyana
149:		: Paraguay
150:		: Peru
151:		: Trinidad & Tobago
152:		: Venezuela
153:	SOUTH ASIA	: Singapore
154:	SOUTHEAST BASE	: Porto Santo & Madeira Islands
155:	SOUTHWEST BASE	: Faial, Graciosa, Pico, Sao Jorge, & Terceira Is.
156:	TIMBALAI 1948	: Brunei & East Malaysia (Sarawak & Sadah)
157:	TOKYO	: Japan
158:		: Korea
159:		: Okinawa
160:	TRISTAN ASTRO 1968	: Tristan da Cunha
161:	VITI LEVU 1916	: Viti Levu Is. (Fiji Islands)
162:	WAKE-ENIWETOK 1960	: Marshall Islands
163:	ZANDERIJ	: Surinam
164:	BUKIT RIMPAH	: Bangka & Belitung Islands (Indonesia)
165:	CAMP AREA ASTRO	: Camp Mcmurdo Area, Antarctica
166:	G. SEGARA	: Kalimantan Is. (Indonesia)
167:	HERAT NORTH	: Afghanistan
168:	HU-TZU-SHAN	: Taiwan
169:	TANANARIVE OBSERVATORY 1925	: Madagascar
170:	YACARE	: Uruguay
171:	RT-90	: Sweden
172:	Pulkovo 1942	: Russia
173:	FINNISH KKJ	: Finland

Digital Interface

Output sentences of channel 1 (HDG OUT)

HDT, HDM, ROT, VTG, ZDA, GGA (Talker: GP)

Output sentences of channel 2 (NAV OUT)

ROT, Gpatt, VTG, ZDA, GGA, GLL

Transmission interval

HDG OUT HDT, HDM, ROT: 100 ms (two of three are selected.)
VTG, ZDA, GGA: 1 s

NAV OUT: Gpatt, ROT: 100 ms (two of three are selected.)
200 ms (other cases)
VTG, ZDA, GGA, GLL: 1 s

Load requirements as listener

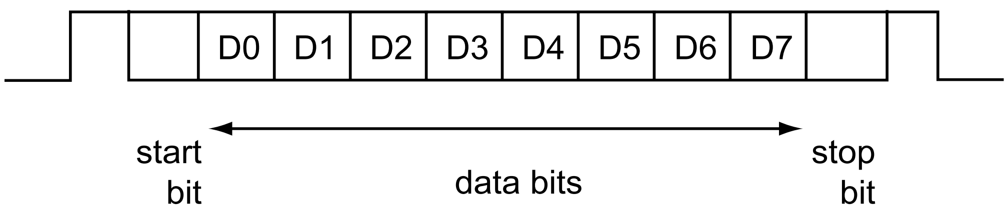
Isolation: Optocoupler
Input Impedance: 220 ohms (due to common use of output port, AD-10 and NMEA)
Max. Voltage: ±15 V
Threshold: 4 mA (In case of connection of FURUNO device talker)

Data transmission

Data is transmitted in serial asynchronous form in accordance with the standard referenced in 2.1 of IEC 61162-1. The first bit is a start bit and is followed by data bits, least-significant-bit as illustrated below.

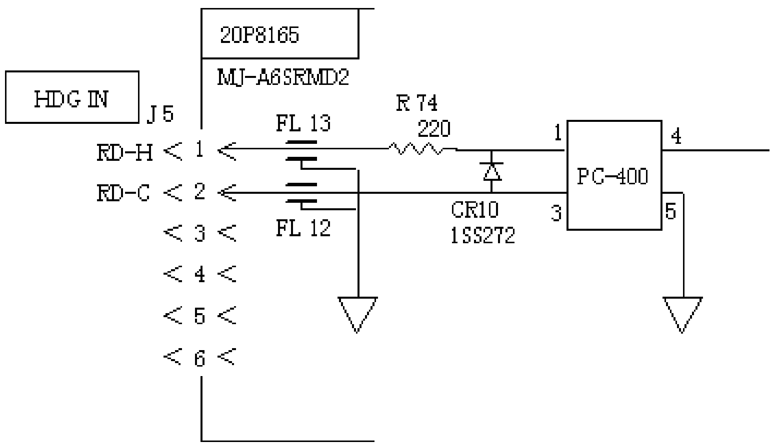
The following parameters are used:

Baud rate: 4800
data bits: 8 (D7 = 0), parity none
stop bits: 1



Schematic diagrams

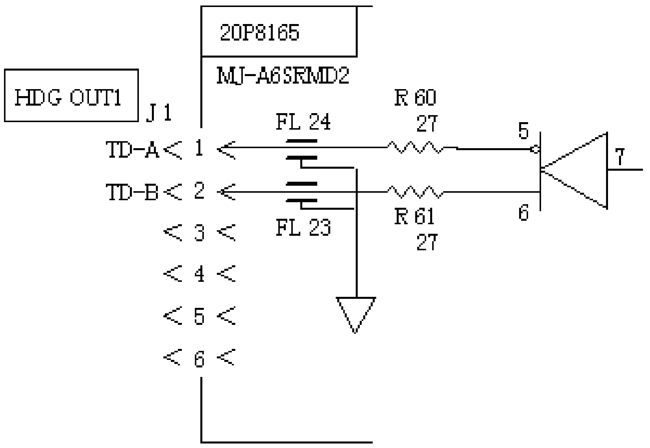
HDG IN port (listener)



Load requirements

Isolation: Optocoupler
Input Impedance: 220 ohm
Max. voltage: ±15V

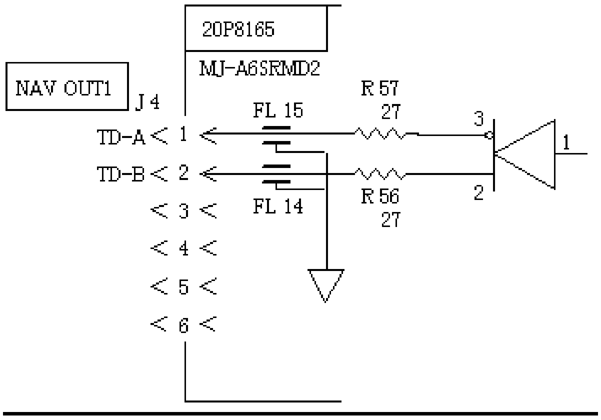
HDG OUT1 port



Output drive capability

Max. 10 mA

NAV OUT1 Port



Output drive capability

Max. 10 mA

HDG4 NAV2 port

RS-232C level

Data sentences

PFECatt- True heading, pitching, rolling

$PFEC,GPatt,xxx.x,+xx.x,-xx.x<CR><LF> (Ver. 1.5)

$PFEC,GPatt,xxx.x,+xx.x,-xx.x*hh<CR><LF> (Ver. 2.0)

Checksum (Ver. 2.0)

Rolling (output to tenths place)

Pitching (output to tenths place)

Heading, true (output to tenths place)

GGA - Global positioning system (GPS) fix data

Time, position and fix related data for a GPS receiver.

Differential reference station ID, 0000-1023

Age of differential GPS data

Units of geoidal separation, m

Geoidal separation

Units of antenna altitude, m

Antenna altitude above/below mean sea level (geoid)

Horizontal dilution of precision

$GPGGA, hhmmss.ss. 1111.11, a, yyyyy.yy, a, x, xx, x.x, x.x, M, x.x, M, x.x, xxxx*hh<CR><LF>

Number of satellites in use, 11-12, may be different from the number in view

GPS quality

Longitude - E/W

Latitude - N/S

UTC of position

GLL - Geographic position - latitude/longitude

Latitude and longitude of present vessel position, time of position fix and status.

$--GPGLL, 1111.11, a, yyyyy.yy, a, hhmmss.ss, A, p*hh<CR><LF>

Positioning system indicator*

Status: A = data valid

UTC of position

Longitude, E/W

Latitude, N/S

*A = Autonomous, D = Differential, E = estimated(dead reckoning), M = Manual input, S = Simulator, N = Data not valid. The Mode indicator field supplements the Status field. The Status field shall be set to V=invalid for all values of Operating Mode except for A=Autonomous and D=Differential. The positioning system Mode indicator and Status field shall not be null fields.

HDM- Heading – magnetic

This sentence is not used in the current version of NMEA and IEC 61162. Some boaters may want the GPS compass to indicate the magnetic heading when the boat is only fitted with a magnetic compass. HDG is calculated by adding a geomagnetic variation to HDT.

$--HDM, x.x, M *hh<CR><LF>

Heading, degrees true

HDT - Heading - true

True heading in degrees obtained by processing RF cycle in the GPS carrier frequency.

$--HDT, x.x, T*hh<CR><LF>

Heading, degrees true

ROT – Rate of turn

ROT derived from a changing rate of GPS compass heading.

$--ROT, x.x, A*hh<CR><LF>

Status: A = data valid

Rate of turn, degrees/min, "-" = bow turns to port

VBW - Dual ground/water speed

```
$--VBW,x.x,x.x,A,x.x,x.x,A,x.x,A,x.x,A*hh<CR><LF>
       |   |  |  |   |  |  |  |  |  |
       |   |  |  |   |  |  |  |  |  +--- 11
       |   |  |  |   |  |  |  |  +----- 10
       |   |  |  |   |  |  |  +-------- 9
       |   |  |  |   |  |  +----------- 8
       |   |  |  |   |  +-------------- 7
       |   |  |  |   +----------------- 6
       |   |  |  +-------------------- 5
       |   |  +------------------------ 4
       |   +--------------------------- 3
       +------------------------------ 2
+---------------------------------- 1
```

1. Longitudial water speed, knots
2. Transverse water speed, knots
3. Status: water speed, A=data valid V=data invalid
4. Longitudial ground speed, knots
5. Transverse ground speed, knots
6. Status: ground speed, A=data valid V=data invalid
7. Stern transverse water speed, knots
8. Status: stern water speed, A=data valid V=data invalid
9. Stern transverse ground speed, knots
10. Status: stern ground speed, A=data valid V=data invalid
11. Checksum

VDR - Set and drift

```
$--VDR,x.x,T,x.x,M,x.x,N*hh<CR><LF>
      |  |   |  |   |  |  |
      |  |   |  |   |  |  +--------- 4
      |  |   |  |   +--+----------- 3
      |  |   +--+----------------- 2
      +--+---------------------- 1
```

1. Direction, degrees true
2. Direction, degrees magnetic
3. Current speed, knots
4. Checksum

VHW - Water speed and heading

The compass heading to which the vessel points and the speed of the vessel relative to the water.

```
$--VHW,x.x,T,x.x,M,x.x,N,x.x,K*hh<CR><LF>
      |  |   |  |   |  |   |  |  |
      |  |   |  |   |  |   |  |  +--------- 5
      |  |   |  |   |  |   +--+----------- 4
      |  |   |  |   +--+----------------- 3
      |  |   +---+---------------------- 2
      +---+---------------------------- 1
```

1. Heading, degrees true
2. Heading, degrees magnetic
3. Speed, knots
4. Speed, km/h
5. Checksum

VLW - Distance travelled through the water

The distance travelled, relative to the water.

```
$--VLW,x.x,N,x.x,N*hh<CR><LF>
      |  |  |  |  |
      |  |  |  |  +--------- 3
      |  |  +---+----------- 2
      +---+---------------- 1
```

1. Total cumulative distance, nautical miles
2. Distance since reset, nautical miles
3. Checksum

VTG - Course over ground and ground speed

COG and SOG obtained by processing the GPS signals.

$GPVTG, x.x, T, x.x, M, x.x, N, x.x, K, p*hh<CR><LF>

- Positioning mode indicator*
- Speed, km/h
- Speed, knots
- Course degrees magnetic
- Course degrees true

*A = Autonomous, D = Differential, E = estimated(dead reckoning), M = Manual input, S = Simulator, N = Data not valid. The Mode indicator field supplements the Status field. The Status field shall be set to V=invalid for all values of Operating Mode except for A=Autonomous and D=Differential. The positioning system Mode indicator and Status field shall not be null fields.

ZDA - Time and date

UTC, day, month, year and local time zone.

$GPZDA. hhmmss.ss, xx, xx, xxxx, xx, xx*hh<CR><LF>

- Local zone minutes description, same sign as local hours
- Local zone description 00 h to ± 13 h (see note)
- Year
- Month, 01 to 12
- Day, 01 to 31
- UTC

NOTE - Zone description if the number of whole hours added to local time to obtain GMT. Zone description is negative for east longitudes.

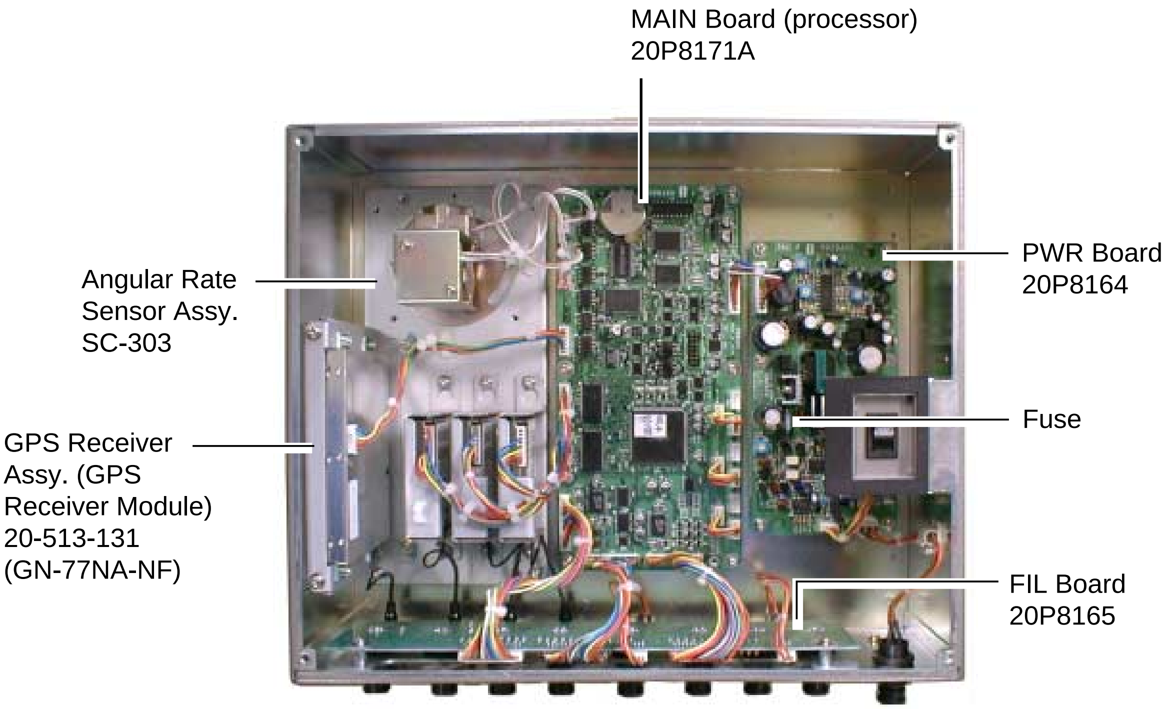
Input/Output Ports

Port Label	Connector Type	I/O	Signal	Remarks
HDG OUT1	MJ6	O	Heading	1) IEC 61162 (NMEA 0183) or AD-10 format (hardware) 2) IEC 61162 (NMEA 0183) Ver.1.5 2.0 (software) 3) Talker: GP 4) Speed: 4800 bps 5) IEC 61162 sentences: HDM, HDT, ROT, VTG, ZDA, GGA (VTG, ZDA, and GGA are factory-set to OFF.) 6) IEC 61162 (NMEA 0183) sentence output interval: HDM, HDT, ROT: 0.1 sec and others: 1 sec 7) AD-10 output interval: 25 ms 8) Signal level: IEC 61162 Heading data selected in the HDG SETUP menu is output.
HDG OUT2	MJ6	O	Heading	
HDG OUT3	MJ6	O	Heading	
HDG OUT4	DSUB9	O	Heading	1) IEC 61162 (NMEA 0183) only 2) Signal level: RS-232C 3) Used for program upgrade
NAV OUT1 (IEC 61162)	MJ6	O	Speed, course, position, and time	1) IEC 61162 (NMEA 0183) Ver.1.5 or 2.0 (software) 2) Talker: GP 3) Speed: 4800 bps 4) IEC 61162 (NMEA 0183) sentences: VTG, GGA, GLL, ROT, ZDA (on/off by menu) 5) IEC 61162 (NMEA 0183) sentence output interval: 1 sec 6) ATT sentence Proprietary sentence or FURUNO sentence Only P sentence: output rate of 0.1 sec Accompanied with any of above sentences: output rate of 0.2 sec ATT sentence – True heading, pitching, rolling $PFEC, Gpatt, xxx.x, +xx.x, +xx.x<CR><LF> (Ver.1.5) $PFEC, Gpatt, xxx.x, +xx.x, +xx.x*hh<CR><LF> (Ver.2.0) 7) Signal level: NAV OUT1: IEC 61162; NAV OUT2: RS-232C
NAV OUT2 (RS-232C)	DSUB9			

Port Label	Connector Type	I/O	Signal	Remarks
LOG/ALARM	MJ7	O	Log signal	200 pulse/nm or 400 pulse/nm (software), 0.5 A max.
			HDG alarm	Heading alarm, 0.5 A max, normal close
HDG IN	MJ6	I	Heading	Heading data in either AD10 or IEC 61162 (NMEA 0183) format (4800 bps) is automatically received. Priority of IEC 61162 (NMEA 0183) sentence is HDT>HDG>HDM. The signal is selected through the menu during the period of internal heading sensor failure. VBW/VHW/VLM may be input from a current indicator.

Note: Each GPS receiver GPS1, GPS2, and GPS3 calculates VTG/GGA/GLL/ZDA. The output from HDG OUT and NAV OUT ports is one calculated by the GPS1. However, when the GPS1 is defective, the GPS2 replaces it. When both GPS1 and GPS2 are defective, the data calculated by the GPS3 is used.

Parts Location



Processor unit, cover removed

Parts List

This equipment contains complex modules in which fault diagnosis and repair down to component level are not practical (IMO A.694(17)/8.3.1. Only some discrete components are used. FURUNO Electric Co. Ltd. believes identifying these components is of no value for shipborne maintenance; therefore, they are not listed in this manual. Major modules can be located on the parts location photo on page A-5.

F U R U N O

ELECTRICAL PARTS LIST

Sep. 2001

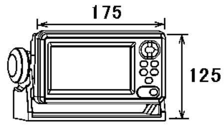
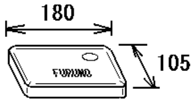
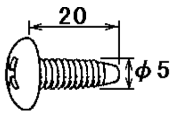
Model	SC-60		
Unit	SC-601 PROCESSOR UNIT		
Ref.Dwg.	C7248-K01-A	Page	
Blk.No.			

SYMBOL	TYPE	CODE No.	REMARKS	SHIPPABLE ASSEMBLY
	PRINTED CIRCUIT BOARD			
B1	20P8171A, MAIN	004-380-270	SC-601/601-D	X
B2	20P8164, PWR	004-377-660		X
B3	20P8165, FIL	004-377-680		X
	ASSEMBLY			
	20-513-131 (GN-77NA-NF)	004-377-970	GPS Receiver assy.	X
	GSC-001	004-382-240	Angular Rate Sensor assy. (SC-303)	X

PACKING LIST

20AT-X-9851 -1 1/1

SC-60/120 (J/E)

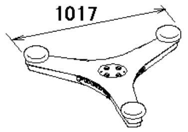
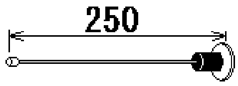
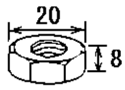
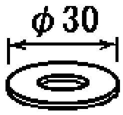
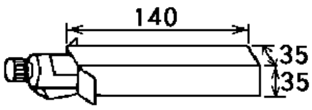
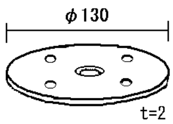
N A M E	O U T L I N E	DESCRIPTION/CODE №	Q'TY
ユニット	**UNIT**		
表示部 DISPLAY UNIT		SC-602 004-377-310 **	1
付属品	**ACCESSORIES**	**FP14-02801**	
保護ｶﾊﾞｰ COVER		20-016-1091-2 100-297-032	1
工事材料	**INSTALLATION MATERIALS**		
+ﾄﾗｽﾀｯﾋﾟﾝﾈｼﾞ +TAPPING SCREW		5X20 SUS304 1ｼｭ 000-802-081	4

ｺｰﾄﾞ末尾に[**]の付いたﾕﾆｯﾄは代表の型式/ｺｰﾄﾞを表示しています。
DOUBLE ASTERISK DENOTES COMMONLY USED EQUIPMENT.

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

PACKING LIST

SC-1203F

N A M E	O U T L I N E	DESCRIPTION/CODE №	Q'TY
ユニット UNIT			
GPSｱﾝﾃﾅ GPS ANTENNA		SC-1203F 000-041-926	1
工事材料 INSTALLATION MATERIALS		**CP20-02241**	
鳥よけ BIRD-REPELLENT FIXTURE		20-024-3101-2 100-315-302	4
六角ﾅｯﾄ　１種 HEX.NUT		M10 SUS304 000-863-111	4
座金 WASHER		10X30-A140 000-809-251	4
ｽﾘｰﾎﾞﾝﾄﾞ SEALANT		1211 50G 000-854-118	1
ｶﾞｽｹｯﾄ GUSKET		JISB2404-5K-50 000-809-250	1

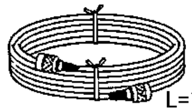
（略図の寸法は、参考値です。　DIMENSIONS IN DRAWING FOR REFERENCE ONLY.）

FURUNO

CODE NO.		20AT-X-9406 -2
TYPE		1/1

工事材料表

INSTALLATION MATERIALS

番号 NO.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS		数量 Q'TY	用途／備考 REMARKS
1	ｹｰﾌﾞﾙ組品 POWER CABLE	 	MJ-A3SPF0013-035		1	
			CODE NO.	000-135-397		
2	ｹｰﾌﾞﾙ組品MJ CABLE ASSY.	 	MJ-A6SPF0007-100		1	
			CODE NO.	000-125-237		
3	ｹｰﾌﾞﾙ組品MJ CABLE ASSY.	 	MJ-A7SPF0006-100		1	
			CODE NO.	000-143-578		

FURUNO ELECTRIC CO .,LTD.

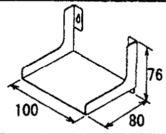
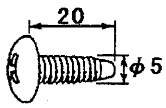
(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO

CODE NO.	004-377-610	20AT-X-9407 -1
TYPE	CP20-02221	1/1

工事材料表

INSTALLATION MATERIALS

番号 NO.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS		数量 Q'TY	用途／備考 REMARKS
1	壁掛用取付板 BULKHEAD MOUNTING PLATE		20-019-1021-0		1	
			CODE NO.	100-284-990		
2	+ﾄﾗｽﾀｯﾋﾟﾝﾈｼﾞ +TAPPING SCREW		5X20 SUS304 1ｼｭ		4	
			CODE NO.	000-802-081		

DWG NO.
C7248-M05- B

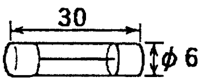
FURUNO ELECTRIC CO ., LTD.

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO

CODE NO.	004-377-600	20AT-X-9301 -0
TYPE	SP20-00901	BOX NO. P

SHIP NO.	SPARE PARTS LIST FOR	U S E	SETS PER VESSEL
	SC-60/120 ｻﾃﾗｲﾄｺﾝﾊﾟｽ SATELLITE COMPASS		

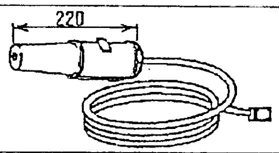
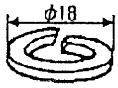
ITEM NO.	NAME OF PART	OUTLINE	DWG. NO. OR TYPE NO.	QUANTITY: WORKING PER SET	QUANTITY: WORKING PER VES	QUANTITY: SPARE	REMARKS/CODE NO.
1	ﾋｭｰｽﾞ FUSE		FGBO-A 3A AC125V	1		3	000-549-063

MFR'S NAME	FURUNO ELECTRIC CO., LTD.	DWG NO.	C7248-P01- A	1/1

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

PACKING LIST

GR-800-1-S

NAME	OUTLINE	DESCRIPTION/CODE No.	Q'TY
ユニット UNIT			
アンテナ部 ANTENNA UNIT		GR-8 000-040-660	1
工事材料 INSTALLATION MATERIALS			
バネ座金 SPRING WASHER		M10 SUS304 000-864-261	1

（略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.）

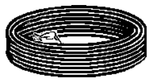
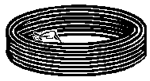
FURUNO

CODE NO.		20AG-X-9404 -1
TYPE		1/1

工事材料表

INSTALLATION MATERIALS

GP-80,GP-90,SC-55,GP-3500/F
GP-1850,GP-1650,FA-100,GP-1640/F
SC-60/120,GD/GP-280/680/380

番 号 NO.	名 称 NAME	略 図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	ｱﾝﾃﾅｹｰﾌﾞﾙ組品 ANTENNA CABLE ASSY.	 L=30M	8D-FB-CV *30M* CODE NO. 000-111-547	1	選択 TO BE SELECTED
2	ｹｰﾌﾞﾙ組品 CABLE ASSY.	 L=50M	8D-FB-CV *50M* CODE NO. 000-117-599	1	選択 TO BE SELECTED

20AG-X-9404

FURUNO ELECTRIC CO ., LTD.

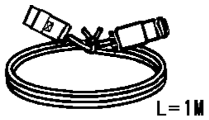
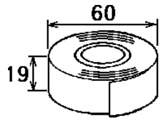
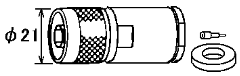
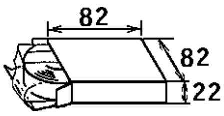
(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO

CODE NO.	004-372-420	20AG-X-9405 -1
TYPE	CP20-01701	1/1

工事材料表

INSTALLATION MATERIALS

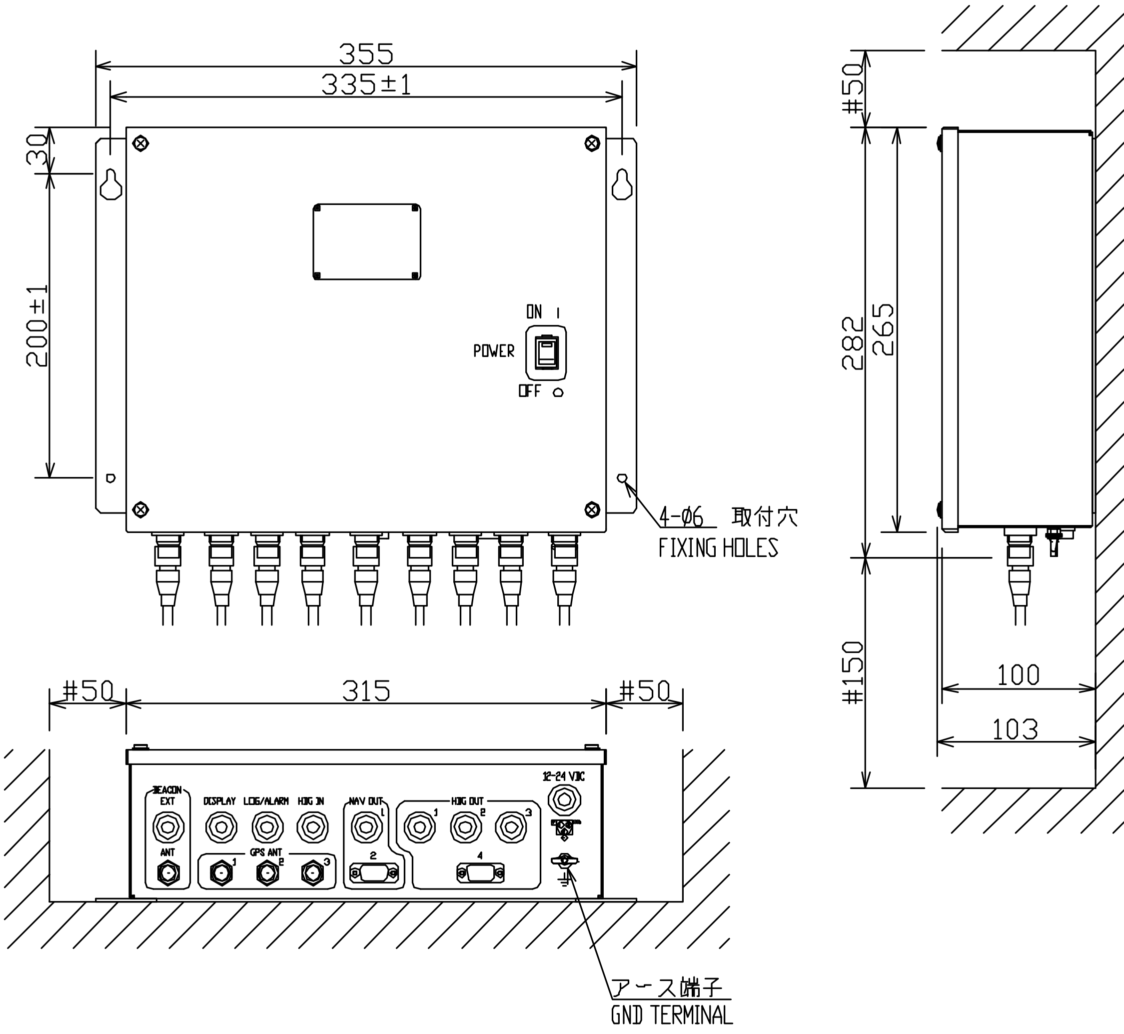
番号 NO.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	変換ｹｰﾌﾞﾙ組品 CONVERT CABLE ASSY.		NJ-TP-3DXV-1 CODE NO. 000-123-809	2	
2	ﾋﾞﾆｰﾙﾃｰﾌﾟ VINYL TAPE		N0360 02X19X10000 ｸﾛ ｴｽﾛﾝ CODE NO. 000-835-215	1	
3	ｺﾈｸﾀ(N) CONNECTOR		N-P-8DFB CODE NO. 000-111-549	1	
4	絶縁ﾃｰﾌﾟ SELF-BONDING TAPE		Uﾃｰﾌﾟ 0.5X19X5M CODE NO. 000-800-985	1	

20AG-X-9405

FURUNO ELECTRIC CO ., LTD.

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO



注　記

１）装備ケーブルはサービス時、本体を前方に十分引き出せるよう余裕を持たせること。

２）取付用ネジはトラスタッピンネジ呼び径５×２０を使用のこと。

３）指定外寸法公差は表１による。

４）＃印寸法は最小サービス空間寸法とする。

NOTE

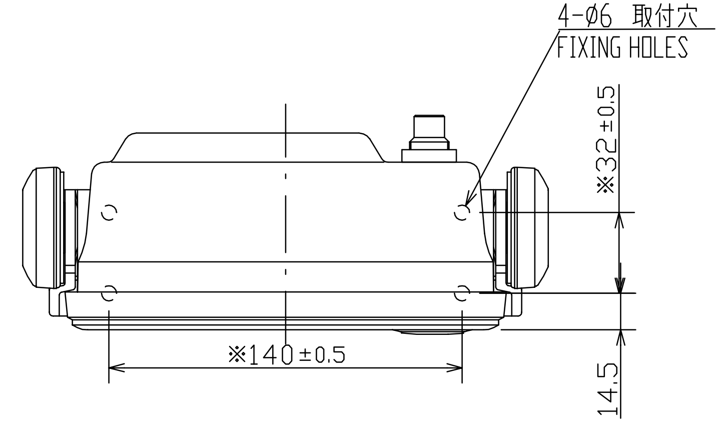
1. KEEP SUFFICIENT CABLE LENGTH BEHIND THE UNIT FOR MAINTENANCE.
2. USE TAPPING SCREWS 5x20 FOR FIXING THE UNIT.
3. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS.
4. #: RECOMMENDED SERVICE CLEARANCE.

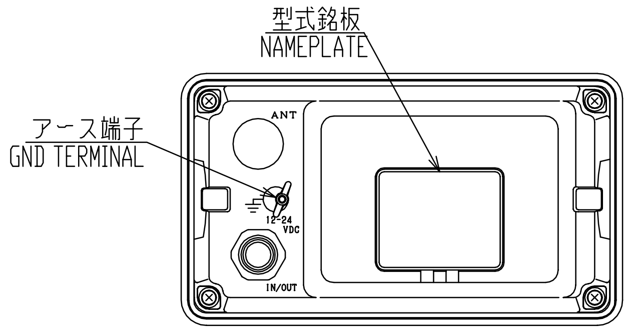
寸法区分（ｍｍ） DIMENSION	公差（ｍｍ） TOLERANCE
０＜Ｌ≦　５０	±１．５
５０＜Ｌ≦１００	±２．５
１００＜Ｌ≦５００	±３

表 1　TABLE 1

DRAWN 2003. May H. MAKI		TITLE	SC-601/601D/1201/1201D/551
CHECKED Takahashi T.		名称	演算部
APPROVED Takahashi T.	SC-60/120/55		外寸図
SCALE 1/5 / MASS 3.6 ±10% kg		NAME	PROCESSOR UNIT
DWG.No. C7248-G01- E	20-019-1000-G0		OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.

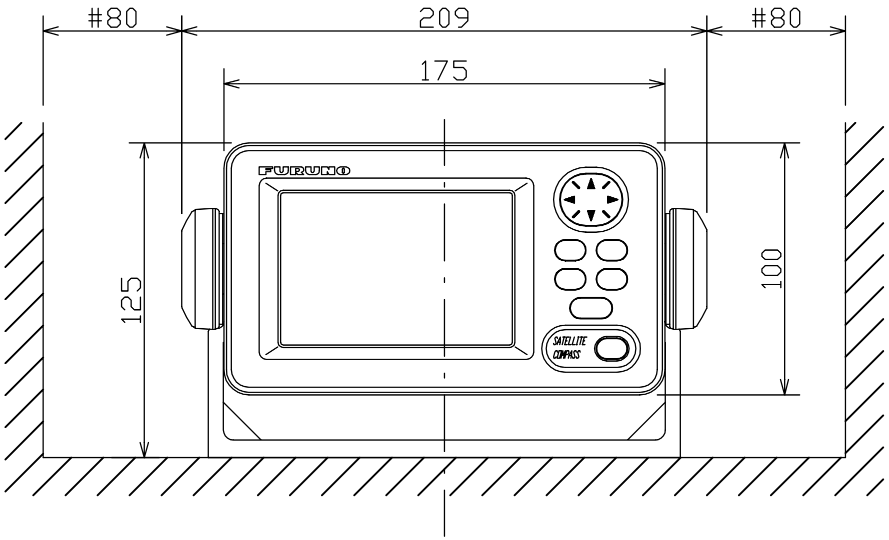


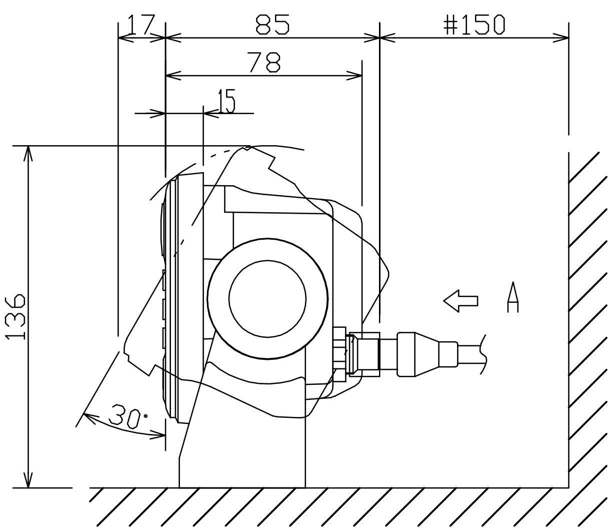


矢視 A VIEW A

表 1 TABLE 1

寸法区分（mm） DIMENSION	公差（mm） TOLERANCE
0＜L≦ 50	±1．5
50＜L≦100	±2．5
100＜L≦500	±3



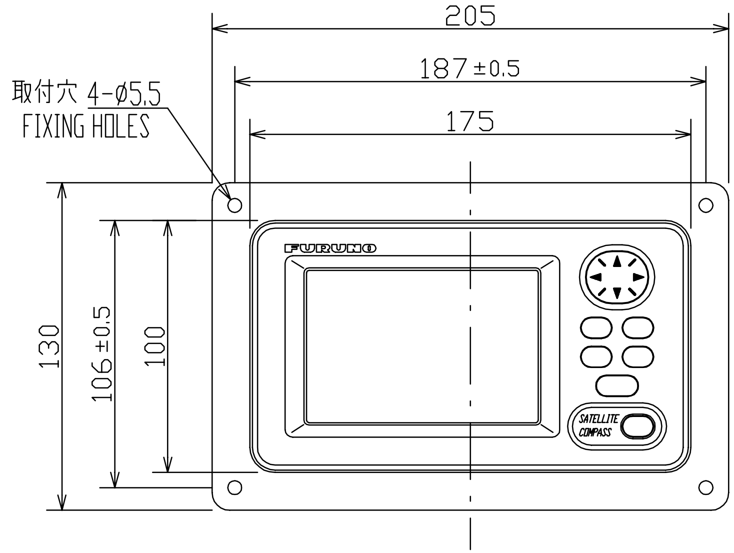


注 記 1）装備ケーブルはサービス時、表示部を前方に十分引き出せるよう余裕を持たせること。
2）※印寸法は取付穴位置寸法とする。
3）取付用ネジはトラスタッピングネジ呼び径５×２０を使用のこと。
4）指定外寸法公差は表１による。
5）＃印寸法は最小サービス空間寸法とする。

NOTE
1. KEEP SUFFICIENT CABLE LENGTH BEHIND THE UNIT FOR MAINTENANCE.
2. ※: DIMENSIONS FOR FIXING HOLE POSITIONS.
3. USE TAPPING SCREWS 5x20 FOR FIXING THE UNIT.
4. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
5. #: MINIMUM SERVICE CLEARANCE.

DRAWN Jan. 17 '04 E. MIYOSHI		TITLE	SC-502/602
CHECKED Takahashi T.	SC-50/110	名称	表示部（卓上装備）
APPROVED Y. Hatai	SC-60/120/155		外寸図
SCALE 1/3 MASS 0.55 ±10% kg		NAME	DISPLAY UNIT (DESKTOP MOUNT)
DWG.No. C7248-G02- H	20-024-200G-0		OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.



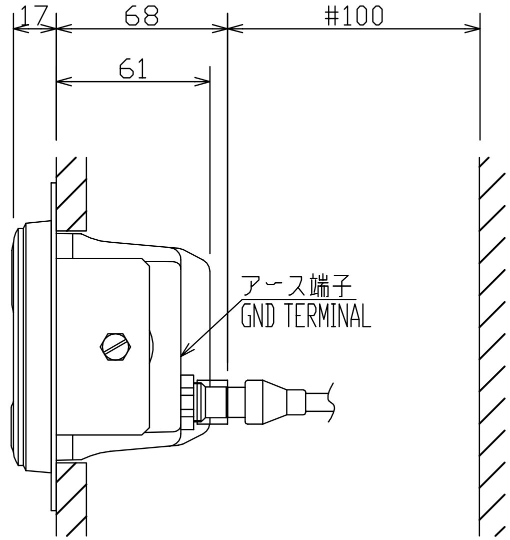
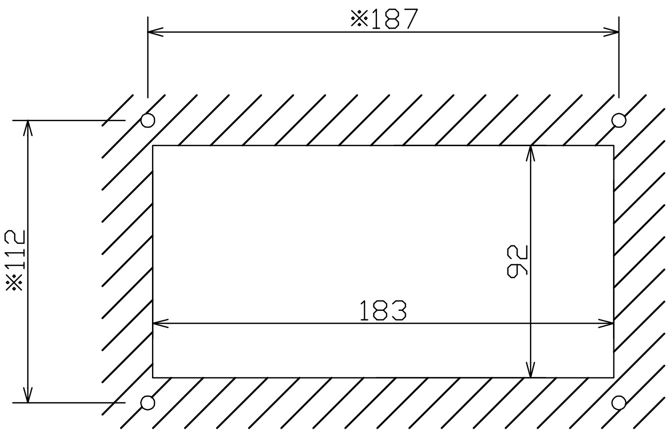


表 1 TABLE 1

寸法区分（mm） DIMENSIONS	公差（mm） TOLERANCE
0＜L≦ 50	±1.5
50＜L≦100	±2.5
100＜L≦500	±3



取付穴寸法図（参考図）
CUTOUT DIMENSIONS

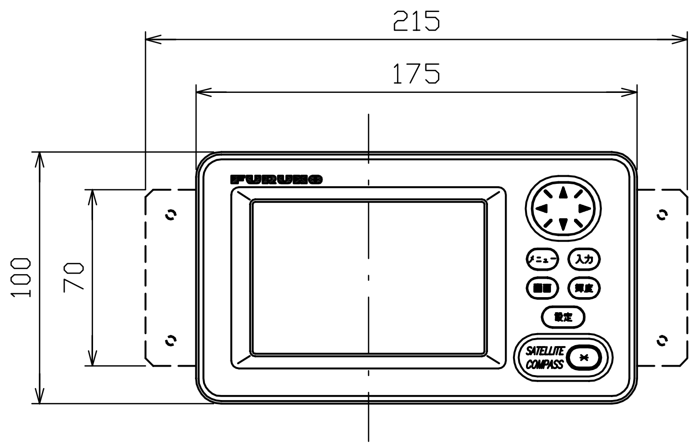
注　記
1） ※印寸法は取付穴位置寸法とする。
2） 取付用ネジはトラスタッピングネジ呼び径５×２０を使用のこと。
3） 指定外寸法公差は表１による。
4） ＃印寸法は最小サービス空間寸法とする。

NOTE
1. ※: DIMENSIONS FOR FIXING HOLE POSITIONS.
2. USE TAPPING SCREWS 5x20 FOR FIXING THE UNIT.
3. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
4. #: MINIMUM SERVICE CLEARANCE.

DRAWN Jan. 17 '04 E. MIYOSHI		TITLE	SC-502/602
CHECKED Takahashi T.	SC-50/110	名称	表示部（埋込装備F）
APPROVED Y. Hatai	SC-60/120/55		外寸図
SCALE 1/3 MASS 0.67 ±10% kg		NAME	DISPLAY UNIT (FLUSH MOUNT F)
DWG.No. C7248-G03-G	20-024-210G-0		OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.

FURUNO



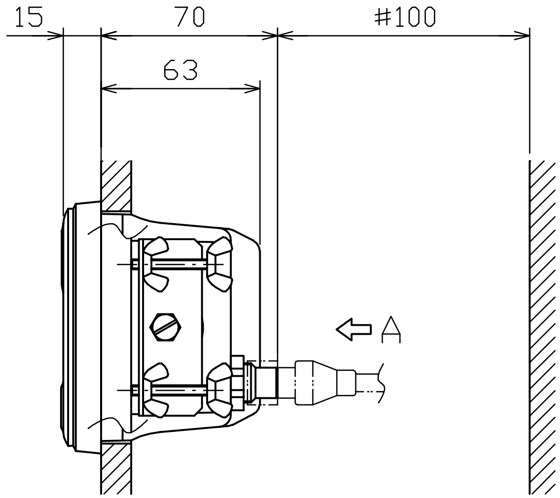
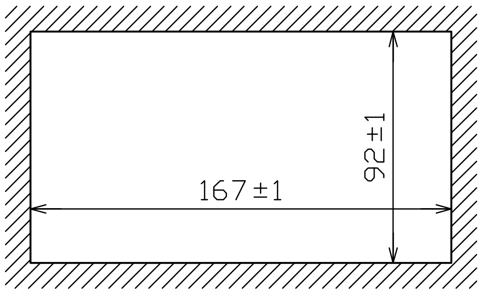
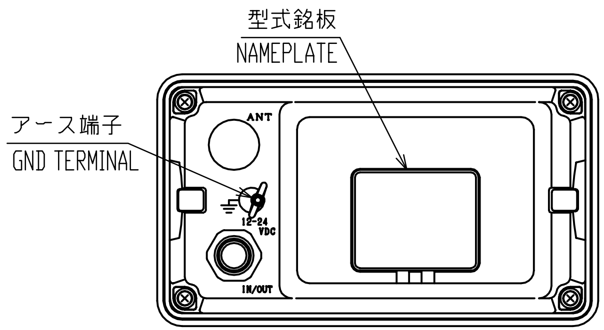


表 1 TABLE 1

寸法区分（mm） DIMENSIONS	公差（mm） TOLERANCE
L≦50	±1.5
50＜L≦100	±2.5
100＜L≦500	±3



取付穴寸法図（参考図）
CUTOUT DIMENSIONS



矢視 A
VIEW A

注 記 1）指定外寸法公差は表１による。
2）＃印寸法は最小サービス空間寸法とする。

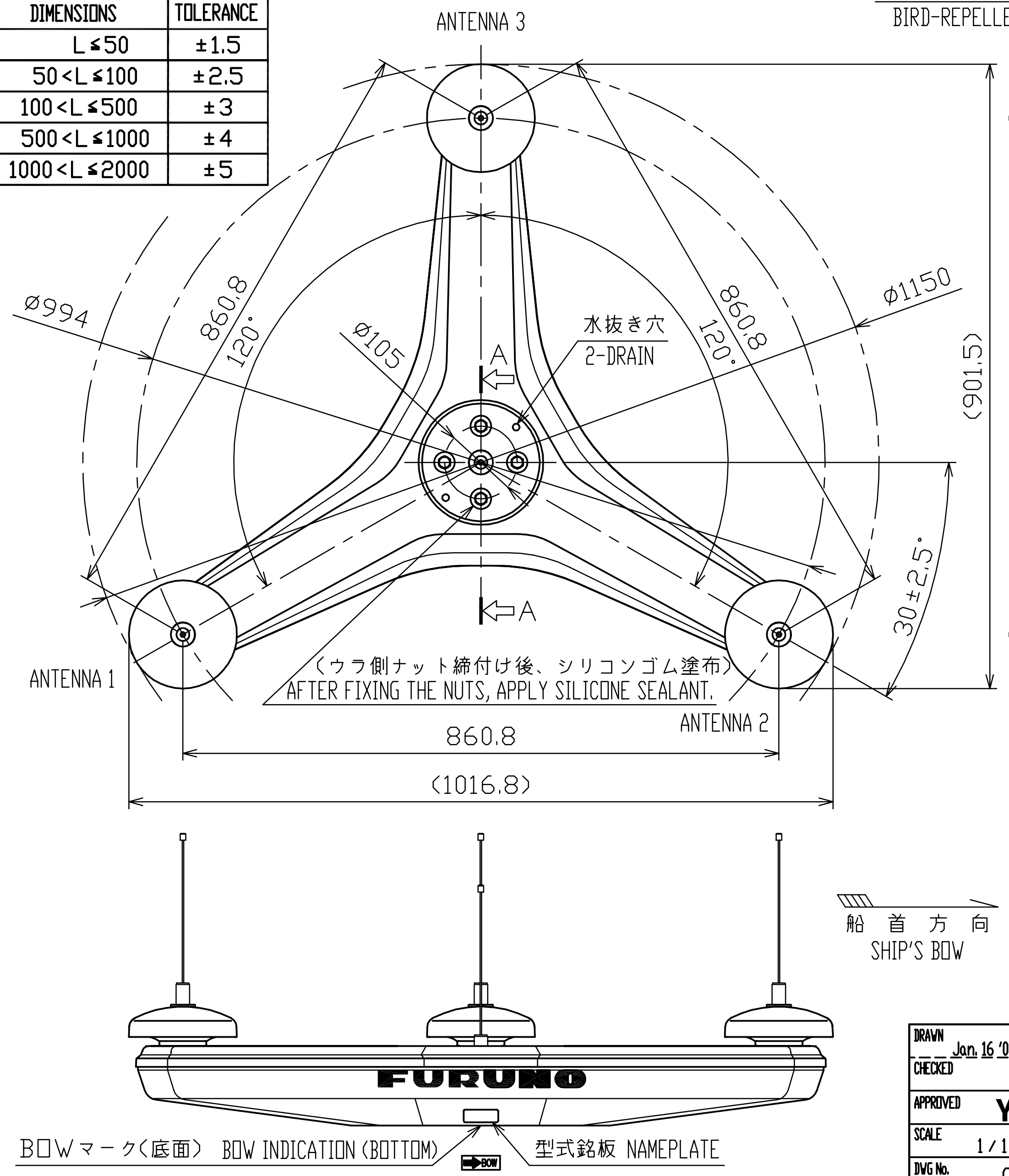
NOTE 1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. #: MINIMUM SERVICE CLEARANCE.

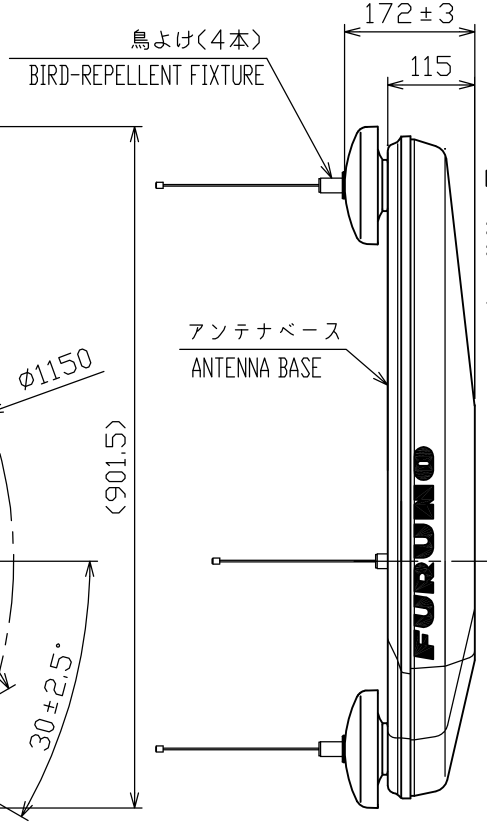
DRAWN Jan 17 '04 E. MIYOSHI		TITLE	SC-502/602
CHECKED Takahashi T.	SC-50/110	名称	表示部（埋込装備S）
APPROVED Y. Hatai	SC-60/120/55		外寸図
SCALE 1/3 MASS 0.69 ±10% kg		NAME	DISPLAY UNIT (FLUSH MOUNT S)
DWG.No. C7248-G04-F	20-024-220G-0		OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.

表 1 TABLE 1

寸法区分 (mm) DIMENSIONS	公差 (mm) TOLERANCE
L≤50	±1.5
50<L≤100	±2.5
100<L≤500	±3
500<L≤1000	±4
1000<L≤2000	±5



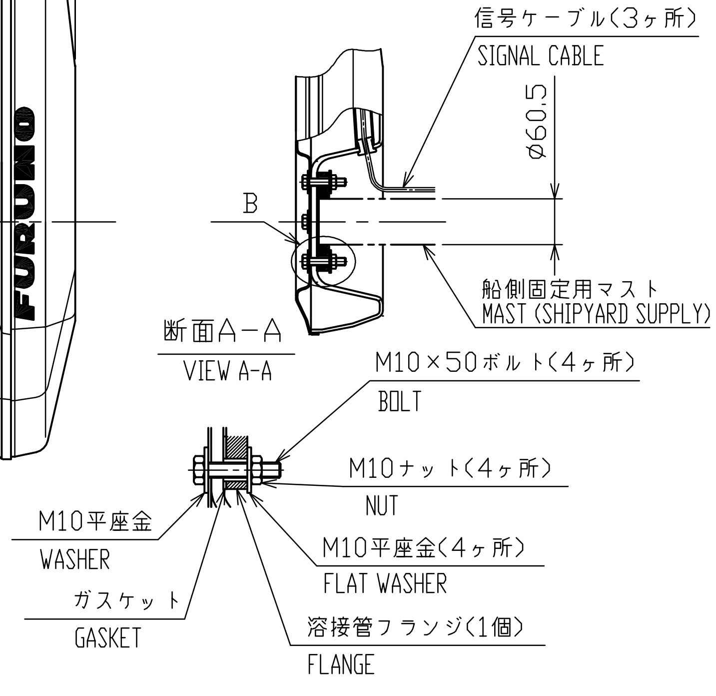


注 記

1) 指定外の寸法公差は表1による。
2) 溶接部は溶接後、防錆処理を施すこと。
3) 取付用のM10ボルト、平座金、ナットは締付け後、シリコンゴムを全面塗布のこと。
4) 質量は工事材料(鳥よけ;0.02kg×4本、ガスケット、M10ナット、平座金)、オプション(溶接管フランジ)を含まず。

NOTE

1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. AFTER WELDING, TAKE APPROPRIATE ANTICORROSION MEASURES.
3) AFTER FASTENING WITH M10 BOLTS, WASHERS AND NUTS, COAT WITH SILICONE RUBBER.
4) MASS DOES NOT INCLUDE INSTALLATION MATERIALS (BIRD-REELLENT FIXTURE, 0.02 kg x 4 PCS.; GASKET, M10 NUT, WASHER NOR OPTIONAL FLANGE).



B部詳細(尺度1/5)
DETAIL B (SCALE:1/5)

船首方向
SHIP'S BOW

DRAWN Jan. 16 '04 E. MIYOSHI		TITLE	SC-1203F
CHECKED Takahashi T.		名称	空中線部
APPROVED Y. Hatai	SC-60/50		外寸図
SCALE 1/10	MASS 6.8 ±10% kg	NAME	ANTENNA UNIT
DWG No. C7249-G02-C	20-019-380G-2		OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.

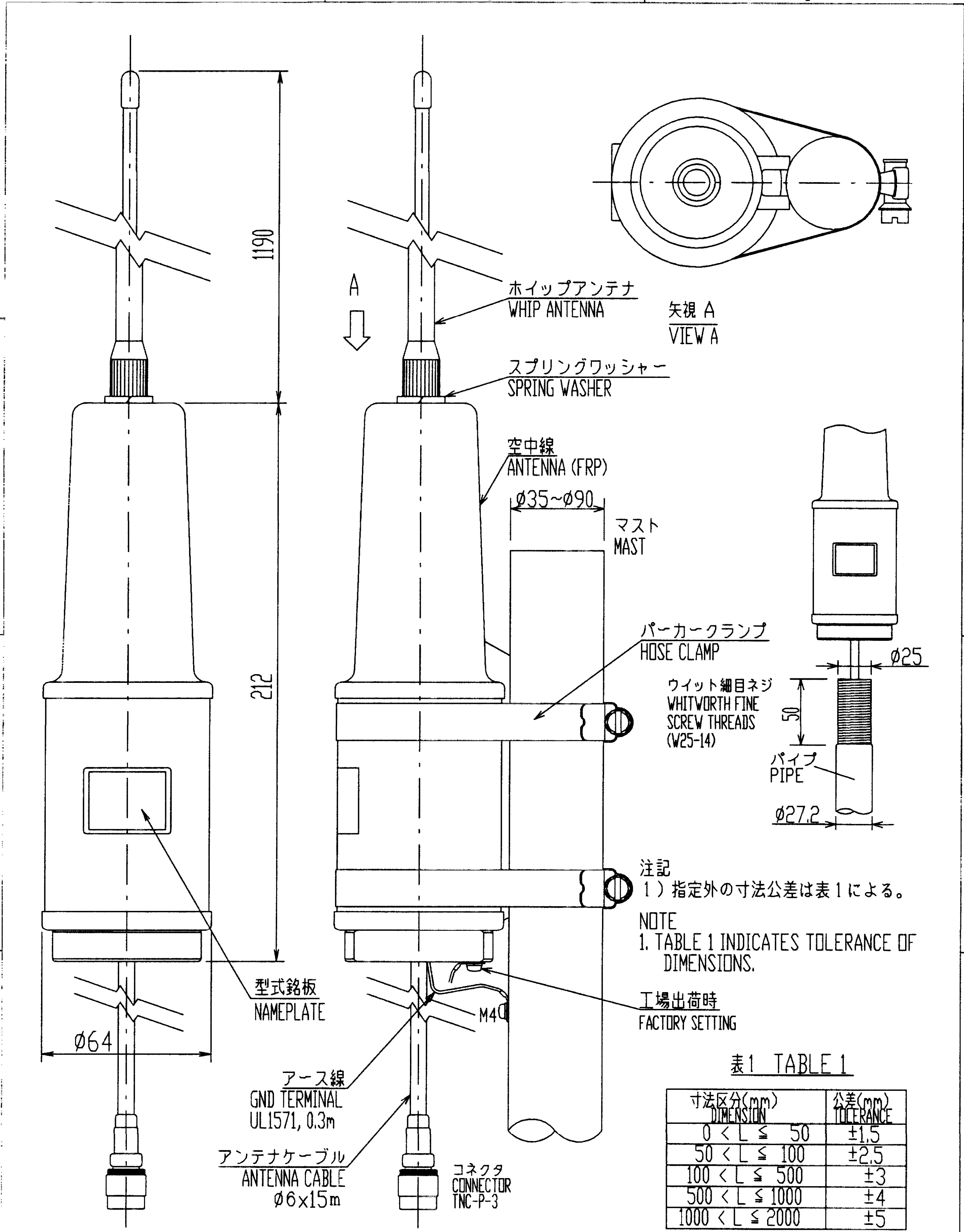


表1 TABLE 1

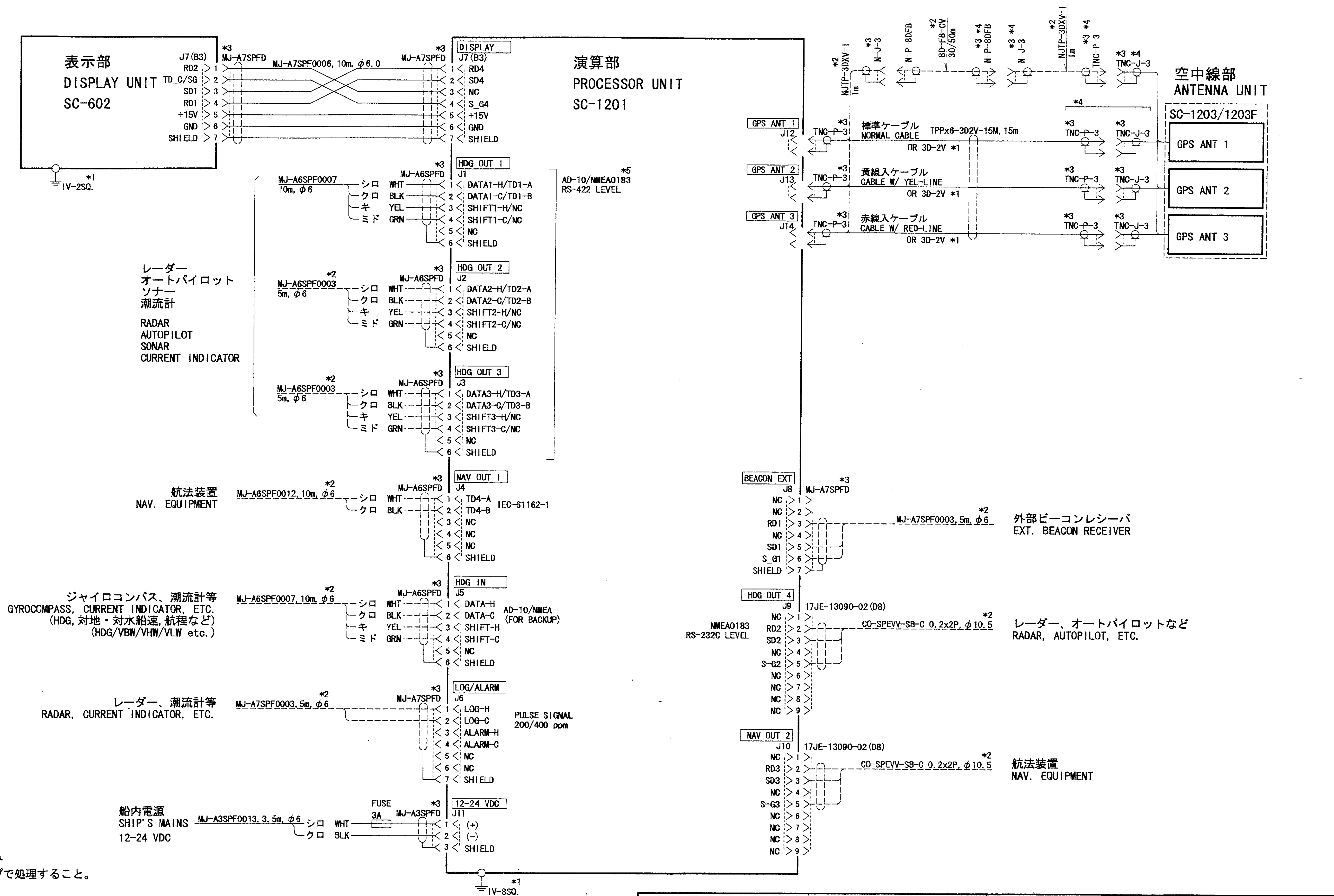
寸法区分(mm) DIMENSION	公差(mm) TOLERANCE
0 < L ≦ 50	±1.5
50 < L ≦ 100	±2.5
100 < L ≦ 500	±3
500 < L ≦ 1000	±4
1000 < L ≦ 2000	±5

DRAWN Oct. 1 '01	T. YAMASAKI	TYPE	GR-8
CHECKED		名 称	アンテナ部
APPROVED			外寸図
SCALE 1/2	MASS 0.6 kg	質量はケーブルを含まず。 MASS: W/O CABLE	NAME ANTENNA UNIT
DWG.No.	C4019-G01- G		OUTLINE DRAWING

FURUNO ELECTRIC CO., LTD.

FURUNO

S－1



注記
＊1）現地手配。
＊2）オプション。
＊3）工場にて取付済み
＊4）防水のためテープで処理すること。
＊5）内部設定切替。

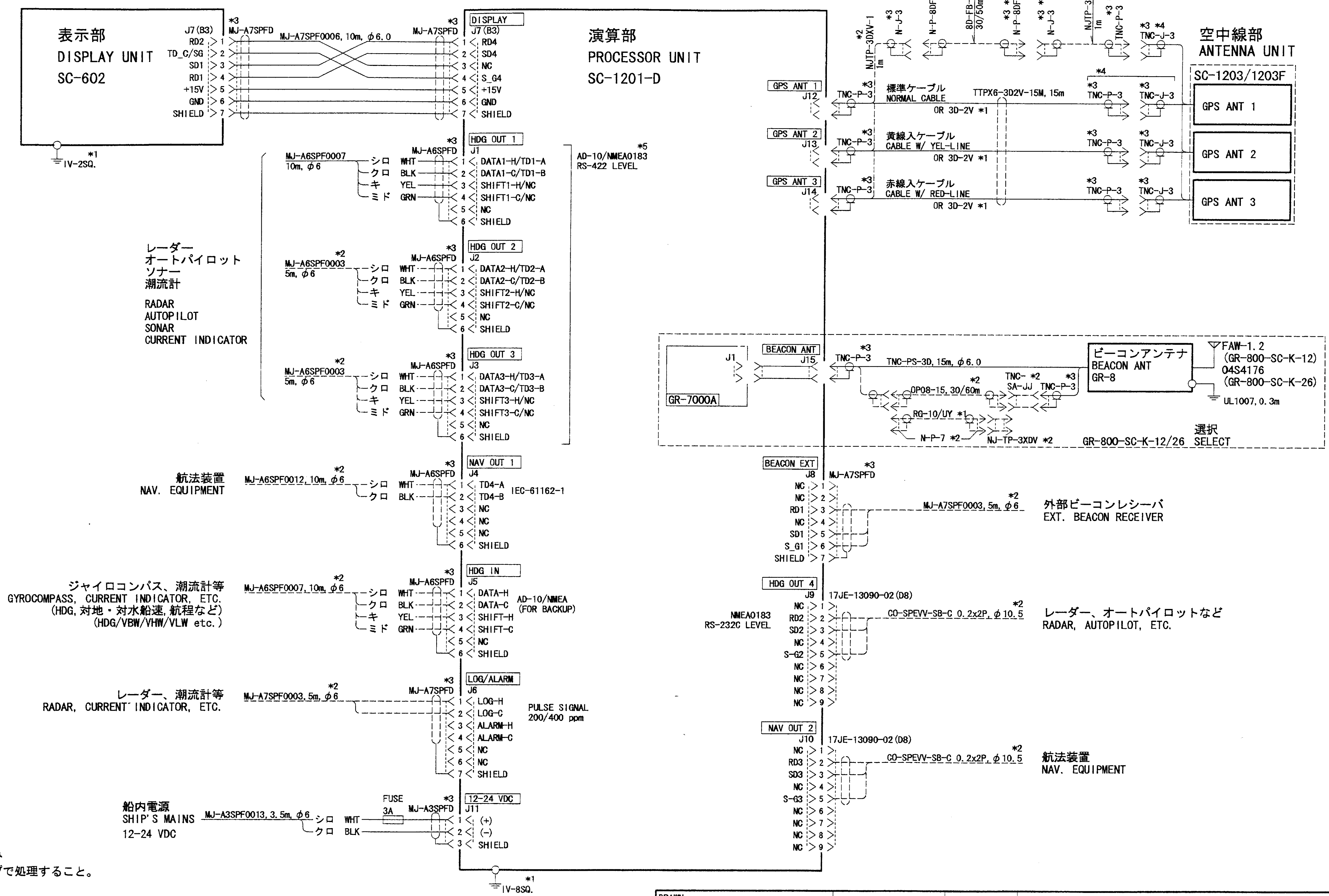
NOTE
*1. LOCAL SUPPLY.
*2. OPTION.
*3. FITTED AT FACTORY.
*4. TAPE FOR WATERPLOOFNESS.
*5. CHANGE INNER SETTING.

DRAWN Jan. 21 '02 T. YAMASAKI	TITLE	SC-120
CHECKED Jan 21 '02 (signature)	名称	サテライトコンパス
APPROVED Jan 21 '02 (signature)		相互結線図
SCALE / MASS kg	NAME	SATELLITE COMPASS
DWG No. C7249-C01- D		INTERCONNECTION DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO

S - 2



注記
＊1）現地手配。
＊2）オプション。
＊3）工場にて取付済み
＊4）防水のためテープで処理すること。
＊5）内部設定切替。

NOTE
*1. LOCAL SUPPLY.
*2. OPTION.
*3. FITTED AT FACTORY.
*4. TAPE FOR WATERPLOOFNESS.
*5. CHANGE INNER SETTING.

DRAWN Jan. 21 '02	T. YAMASAKI	TITLE	SC-120 (DGPS)
CHECKED Jan. 21 '02	Y. K.	名称	サテライトコンパス
APPROVED Jan. 21 '02	Y. K.		相互結線図
SCALE	MASS kg	NAME	SATELLITE COMPASS
DWG No.	C7249-C02- D		INTERCONNECTION DIAGRAM

FURUNO ELECTRIC CO., LTD.

INDEX

FURUNO

FURUNO ELECTRIC CO., LTD.
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Tel: +81 798-65-2111 Fax: +81 798-65-4200

Pub NO. DOC-410

Declaration of Conformity CE 0560

We FURUNO ELECTRIC CO., LTD.

(Manufacturer)

9-52 Ashihara-Cho, Nishinomiya City, 662-8580, Hyogo, Japan

(Address)

declare under our sole responsibility that the product

Satellite compass Model SC-120 consisting of Display unit SC-602, Processor unit SC-1201, Antenna unit (either one of SC-1203 or SC-1203F) and optional DGPS beacon antenna GR-8

(Model name, serial number)

is in conformity with the essential requirements as described in the Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment (R&TTE Directive) and satisfies all the technical regulations applicable to the product within this Directive

EN 60945: 1997-01 (IEC 60945 Third edition: 1996-11)

(title and/or number and date of issue of the standard(s) or other normative document(s))

For assessment, see

- Statement of Opinion N° 01214075/AA/00 of 20 April 2001 issued by KTL Certification, The Netherlands
- Test report FLI 12-01-014 of 6 February 2001 prepared by Furuno Labotech International Co., Ltd.

On behalf of Furuno Electric Co., Ltd.

Nishinomiya City, Japan
February 14, 2002

(Place and date of issue)

Hiroaki Komatsu
Manager,
International Rules and Regulations

(name and signature or equivalent marking of authorized person)